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CONTENTS

	PAGE
Editorials	547
Letters to the Editor	551
The Scrap Heap	554
Overseas Railway Affairs	555
Reproducing the Wearing Qualities of Early Steel Rails	557
The Railways of Czechoslovakia	562
Igranic Low-Voltage Safety Lighting	565
New Station at Apsley	566

DIESEL RAILWAY TRACTION

A Supplement illustrating and describing developments in Diesel Railway Traction is presented with every copy of this week's issue

Mr. Alfred Raworth, Chief Electrical Engineer, Southern Railway

IN assuming entire responsibility for the whole of the Electrical Department of the Southern Railway, Mr. Alfred Raworth, hitherto Electrical Engineer for New Works of the company, takes up one of the most important positions in the electric traction industry and one, moreover, for which he is eminently fitted both by experience and heredity. His father, the late Mr. John S. Raworth, was one of the pioneers of the electrical industry of this country, to which he made his entry as assistant to Alderman John Hopkinson in Manchester. As the result of a visit in 1878 to the Siemens works at Woolwich, Mr. J. S. Raworth became associated with that company and established a connection which lasted until about 1897. He then joined the board of directors of the British Electric Traction Co. Ltd., an office which he held until his death in 1917, and played a prominent part in tramway and light railway electrification. He was a prolific inventor, and Raworth Traction Patents Limited will be recalled for its important early work in connection with regenerative braking. Mr. Alfred Raworth acted as assistant to his father from 1903 until 1912 so that when in March of the latter year he was appointed Chief Assistant to the Electrical Engineer of the old L.S.W.R. he took with him a valued tradition and experience. As we record in our biographical notice on page 569, Mr. Raworth became Electrical Engineer to the South Eastern & Chatham in March, 1918, and at the end of the same year visited the U.S.A. to study developments there in connection with the preparation of a comprehensive scheme for S.E. & C.R. suburban electrification. The work, for which extensive preparations were made, was not however carried out until after grouping, but Sir Herbert Walker arranged for Mr. Raworth to remain in charge of the whole of the Eastern Section of the suburban electrification. It was on the completion of this work that he was appointed in July, 1925, Electrical Engineer for New Works to the Southern Railway.

* * * *

The Late Sir Philip Dawson

It is a coincidence that in the same week as we announce an important change in the Southern Railway Electrical Department, we have to record the death of a pioneer of electrification on a constituent of that system. Sir Philip Dawson who, as recorded on page 569, died on September 24 in Berlin while returning home from a congress in Warsaw, was Consulting Engineer to the former London Brighton & South Coast Railway for that company's first electrification schemes. In 1903 Mr. Dawson, as he then was, was instructed by the L.B.S.C.R. to report on the whole question of electrification, including the conversion of the main line to Brighton. As the result of his report, Mr. Dawson was further instructed to prepare specifications and call for tenders, which were issued in 1905. The contract for the first electrification, comprising the $8\frac{3}{4}$-mile South London line from Victoria to London Bridge *via* Denmark Hill, was let in 1906. The adoption of the 6,700-volt single-phase a.c. system for this and subsequent L.B.S.C.R. suburban conversions arose from the fact that electrification to the coast was contemplated from the first, and at that period high-tension a.c. was the best developed system for long-distance transmission.

* * * *

The Week's Traffics

Although none of the four main line companies shows a total increase in traffics for the past week in comparison with the corresponding week in 1937, there is a further slackening in the rate of decrease which is £154,000 against £183,000 in the previous week.

	38th Week				Year to date	
	Pass., &c.	Goods, &c.	Coal, &c.	Total	Inc. or Dec.	
	£	£	£	£	£	%
L.M.S.R. ..	+ 11,000	− 81,000	− 14,000	− 84,000	− 1,768,000	− 3·64
L.N.E.R. ..	+ 2,000	− 35,000	− 14,000	− 47,000	− 1,457,000	− 4·12
G.W.R. ..	—	− 19,000	− 2,000	− 21,000	− 819,000	− 4·01
S.R.	+ 4,000	− 5,500	− 500	− 2,000	− 191,000	− 1·16

In the following table comparisons are made with the figures for the corresponding week in 1936.

	38th Week				Year to date	
	Pass., &c.	Goods, &c.	Coal, &c.	Total	Inc. or Dec.	
	£	£	£	£	£	%
L.M.S.R. ..	+ 15,000	− 57,000	+ 18,000	− 24,000	+ 246,000	+ 0·53
L.N.E.R. ..	+ 2,000	− 15,000	—	− 13,000	+ 225,000	+ 0·67
G.W.R. ..	+ 3,000	− 14,000	+ 8,000	− 3,000	+ 243,000	+ 1·25
S.R.	+ 23,000	− 8,500	+ 1,500	+ 16,000	+ 521,000	+ 3·32

Traffics to date in 1938 are up £2,227,000 on the passenger side in comparison with 1936, and coal shows a net increase of £688,000, but merchandise is down by £1,680,000.

* * * *

The "Pringle Committee"

Mr. Herbert Jones, who retires tomorrow from the post of Electrical Engineer, Southern Railway (see page 569), has served on numerous committees during his 38 years as a chief officer of a railway company. Perhaps that which will affect the future most was the Railway Electrification Committee (1927), which is frequently referred to as the "Pringle Committee." This committee made certain recommendations which were subsequently embodied in an Order of the Minister of Transport known as the Railway (Standardisation of Electrification) Order, 1932. A feature of this Order frequently overlooked is that it lays down the standards for future electrification throughout this country, and should dispose of all wrang-

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ling about systems of electric traction so far as we are concerned. Possibly the reason why it is not so well known as it should be is that a certain amount of technical knowledge is required in order to understand clearly what the Order means, and that, although overhead contact wires working at voltages between the limits of 1,200 and 1,500 and conductor rails working at voltages between the limits of 600 and 750 are permissible, provision for through running of rolling stock when necessary is made.

* * * *

The Late Mr. W. J. Bell

Not only railway journalism, but the world of "railwayism" for its own sake has suffered a sad loss in the person of Mr. Walter J. Bell, whose death is announced in our Personal columns. At the same time a practical locomotive man and an indefatigable historian, he possessed that peculiarly persistent love of his subject which makes certain men explore, in the course of a lifetime, every possible line of railway, and every place of railway or locomotive interest, from Caithness to Kerry, with plenty over. W. J. Bell was a good mixer. Railway lovers young and old found in him a genial friend with an encyclopædic knowledge of the things in which their hearts delighted. The march of years, and the handicap of deafness which came with them, seemed not to hinder his activity; only a week before his passing he was to be seen on the "1888 Flying Scotsman," in the midst of a party numbering several hundreds, most of whom were young enough to be his sons, enjoying with supreme gusto an experience which was an interesting commonplace in his own youth. Two generations of people, belonging to both the serious and the enthusiastic sides of the railway world, have lost an old friend.

* * * *

American Railway Wage Dispute

Executives of three large railways in the United States and representatives of the railway unions had a conference last week with President Roosevelt on the claim of the railway companies for a reduction of 15 per cent. in wages and on the question of improving the financial position of the railway companies. Mr. Roosevelt, according to a Reuters message, asked the participants in this conference to act as an informal committee to work out a legislative programme for the rehabilitation of the railways, and promised the assistance of the administration in putting such a programme through Congress. The union leaders, however, refused to co-operate unless, and until, the railways withdrew their demand for a 15 per cent. reduction in wages. Later it was announced by the committees of the railroad managements and railway labour that the conferences on the formulation of a railroad rehabilitation programme would be adjourned until the wage issue had been settled. An indication was subsequently given by the railway managements that they had no intention of backing out of their demand for a reduction in wages. It is accordingly regarded as most probable that the wage question will go before the Presidential "fact finding" board tomorrow (October 1), and that until that has been solved through the regular processes of the Railway Labour Act the rehabilitation programme will be postponed.

* * * *

What's in a Name?

British railway history provides quite a number of examples of difficulties experienced in selecting suitable names for railway companies without offending local pride. One which comes readily to mind is that of the London & Southampton Railway, which found it necessary to alter its name to the London & South Western Railway in order to placate Portsmouth. Here, as in many other cases, the selection of a "compass-point" title proved a happy solution to the problem. The longest-lived name for a great railway—the Great Western Railway—probably owes its longevity to its euphonious comprehensiveness, for the originally-proposed "Bristol & London Railway" could scarcely have served for 103 years. Since the war the problem was renewed at the time of grouping, and it is noteworthy that all the main-line companies eventually avoided using provincial town names. An earlier grouping difficulty formed the subject of an interesting letter to *The Times* last week which was occasioned by the Euston centenary celebrations. This letter stated—on the strength of family recollections—that in 1846 the constituents of the L.N.W.R. suggested the "London, Birmingham & Manchester" for their new title. To shorten it "London & Manchester" was suggested, but immediately evoked Birmingham protests, and the happy suggestion of "London & North Western" is credited to Mrs. Carr Glyn (afterwards the first Lady Wolverton). The words, of course, formed an honoured name for over 70 years.

* * * *

Steel Rail Economics

A point of some importance, concerning the use of specially hard-wearing qualities of rail, was raised in one of the discussions at the recent International Rail Congress at Düsseldorf. The Chief Engineer of the Hamburg Elevated electric railway, in strongly commending the compound type of rail—with head of special hard-wearing steel and web and foot of normal quality—remarked that if a compound rail costs twice as much as a plain rail, but lasts four times as long, the prime cost of the rails is reduced by 50 per cent., while the saving is further increased by the fact that three successive relaying or rerailing operations have been avoided, which is an important point in busy electric lines where track work can only be carried out at night, when the traffic is stopped. A British delegate pointed out, however, that one essential factor had been omitted from this calculation, and that was the scrap value of the three lots of ordinary rails recovered in the three replacements, which provided a substantial offset to the relaying costs. We have known cases in which this scrap value, properly taken into account in assessing the ultimate economy of rails of exceptional wearing quality and high price, has turned what at first sight appeared to be an attractive saving into an actual loss.

* * * *

"Express" in the U.S.A.

As recently as July 22 last we outlined the distinctive position occupied in American transport by the express companies, and then pointed out that since March 1, 1929, the majority of the business had been in the hands of the Railway Express Agency, Inc., of which control was acquired jointly by the large American railway companies. Within the last week or two arrangements have been completed by the Railway Express Agency whereby it took over on August 1 express operations on the Southern Railway, the Mobile & Ohio RR., and 27 other lines. In so doing, the R.E.A. succeeded the Southeastern Express Company, which withdrew from the express business on that date. The transfer was made without interruption to the service. The development came as a result of an operating agreement made by the various railroads and express companies involved, which received the approval of the Interstate Commerce Commission on June 1. It had the effect of enabling the Southern Railway system to gain proportionate owner-

ship in the R.E.A., under the same plan embracing the 86 Class I railroads which participated in its formation in March, 1929. The incorporation of former South-eastern express operations into those of the R.E.A. has added 9,643 miles of steam railroad lines to the nearly 200,000 rail mileage of the agency.

* * * *

The Reichsbahn in Austria

Considerable activity is reported in Austrian railway circles since the introduction of the new administrative arrangements. Particular attention has been given to improving the condition of the rolling stock, and the air brake is to replace the vacuum as quickly as possible. Out of 450 locomotives waiting to be repaired at the time of the *Anschluss*, 100 have now been put into serviceable condition and are at work. Orders for new stock have been issued and works in the old Germany are co-operating towards quick deliveries. Among these are 10 heavy steam locomotives, 35 others of the German standard design for goods traffic, 14 electric locomotives, 10 diesel-electric railcars, 20 driving railcar trailers, 100 eight-wheel passenger vehicles and 1,000 covered freight wagons. Orders placed between March 18 and July 1, 1938 are stated to have totalled over 55 million marks, while those given by the old Austrian administration from the beginning of the year until the transfer to the Reichsbahn totalled only 9 millions. How far steps have yet been taken to standardise operating practice, signalling, and so forth, has not yet been announced, but considerable changes will have to be made in due course.

* * * *

Speed and Comfort in Holland

Several references have been made in previous issues of THE RAILWAY GAZETTE to the complete revolution which has been effected in the speed of railway transport in Holland since the introduction of the 1938-39 timetables in May last. We have recently had the opportunity of sampling the new services, both diesel and electric, and the efficiency and strict punctuality with which they are being worked is remarkable. On a typical run with four of the three-car diesel sets coupled together and operated multiple-unit—a common practice in Holland—the 13·1 miles from Utrecht to Amersfoort were run in 12 min. 42 sec., and the 41·4 miles from Amersfoort to Zwolle in 36 min. 55 sec., in both cases from start to stop. On the first section a sustained speed of 77½ m.p.h. was reached, with a maximum of 79, and the 67·3 m.p.h. start-to-stop average of the second included a bad bridge repair slack, two slacks for curves (50 and 60 m.p.h.), and long stretches at 77½ m.p.h. with a maximum of just 80 m.p.h. The electric services are nearly as fast; for example, two three-car sets coupled covered the 21·7 miles from Amsterdam to Utrecht in 21 min. 34 sec., notwithstanding a signal stop, and this entailed maximum speeds up to 77 m.p.h. The perfection of the riding qualities of both diesel and electric stock also deserves warm commendation.

* * * *

The Arnoux System for Severely Curved Railways

The recently-electrified line from Paris (Luxembourg) to Sceaux-Robinson was originally constructed to a gauge of 5 ft. 9 in., and operated at first with articulated stock and special locomotives to which brief reference was made in our issue of June 10. Claude Arnoux, engineer of the line, adopted these special measures to meet the severe curvature involved between Fontenay-Aux-Roses and Sceaux. Here, in covering a distance of 700 yd. the railway described curves totalling nearly 1¼ miles to compensate for a difference in level of 72 ft. The feature of the rolling stock was that every wheel was mounted on an independent, swivelling stub-axle. Equally unusual were the first locomotives, which had a pair of flangeless driving wheels, and pivoted carrying axles at front and rear furnished both with ordinary flanged wheels and guide wheels, the latter mounted at an angle to bear against the inside of the rails. When, in 1854, the first coupled engines for the line were built, the right- and left-hand pairs of coupled wheels were driven independently, two cylinders actuating each pair. Engines of this type remained in service until 1867, and both the guide-wheel and articulation principles were adhered to until May 22, 1891, by which date the line had been converted to standard gauge and its alignment improved.

* * * *

Railway Rolling Stock Suspension

A steel-tyred wheel running on a steel rail possesses the valuable property of very low rolling resistance, but at the same time it gives rise to high-frequency vibrations and noise caused by small surface irregularities which, once started, are difficult to stop. These vibrations are transmitted through the steel springs in much the same way as an electric current, and nothing but complete metallic separation of the underframe from the bogies can suppress them. There is, further, the discomfort caused by lateral movement or changes of acceleration setting up swaying or rolling motions, which are probably more troublesome than the vertical acceleration. Little appears to have been done in rolling stock design to cushion lateral shocks caused by the wheel flanges, or to damp out rolling. In this connection Mr. H. J. Nichols, the author of a paper on the "Development of Passenger Rolling Stock," read at a meeting of the Institution of Locomotive Engineers in India, proposed that the most intensive research should be undertaken to put the springing of passenger rolling stock on a level with that reached by the best automobile practice, and, in fact, in advance of it, since it must obtain equally good results without the help of pneumatic tyres. Highly developed springing and damping will not only save the track and be appreciated by passengers, but will also make possible the use of really lightweight passenger stock with low maintenance costs.

* * * *

Slander in Song

Usually it was the railways running south from London, that evoked the ribaldry of comedians, and to such good purpose that even the hard-headed North began to believe in their shortcomings. Yet the North itself was not without its railway comic songs, although their pernicious sentiments seem to have been confined mainly to misleading local minds. We are reminded that a certain railway of which Southerners thought, if they thought of it at all, as respectable but uninspiring, once figured by name in a wicked old music-hall ditty. The burden of the song was the adventure of a party of friends travelling to "dine with Eliza." It seems that they missed their connection at a certain well-known junction, for the ballad relates that they spent three hopeless weeks on its inhospitable platforms waiting for the next train. When at length they complained to the proper authority, it was only to receive the somewhat belated information that they "ought to have started a year before if they wanted to dine with Eliza." The railway concerned now happily basks in the genial warmth of public approval, but there may be some of our readers who can identify the locality, and recall the conditions inspiring this extravagant distortion of the truth.

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Reduced Fare Travel

APART from the generally advertised arrangements for rail travel at reduced fares in Great Britain, the four main line companies grant quite an extensive variety of other cheap fare facilities which it is unnecessary to advertise as they are arranged through the organisations or associations concerned. In a number of instances these concessions have been granted on compassionate grounds and the issue of the cheap tickets is usually conditional upon the production of a signed voucher or other special authority. Special treatment is accorded, for instance, to commercial travellers who play such a large part in our national business life and, upon surrender of a voucher or production of a certificate of identity at the time of booking, an appreciable reduction from the ordinary fare is allowed. Thus they can obtain return tickets at the single fare, available on the day of issue only or, if they desire to visit their homes, " overnight " tickets may be obtained at the same fare entitling them to travel to their home station any time after 2 p.m. on the day of issue and return by any train leaving up to 10.30 a.m. the following day. Week-end tickets are also issued to commercial travellers at the single fare for the return journey, subject to a minimum fare of 2s. 6d., with a maximum availability from Friday to Tuesday. The companies have for some years given special consideration to relatives and friends visiting institutions for blind or mental patients, as well as to unemployed persons travelling from Government training centres to their homes and, upon production of an authorised voucher, return tickets are issued at the single fare. For blind persons travelling for business purposes and their attendants, half the ordinary single or monthly return fare is charged upon surrender of a signed certificate.

Another—and important— section of the community is assisted by the issue of fishworkers' tickets. The annual visitation of shoals of herrings to the North Sea provides intensive work for a short period to many workers engaged in the cleaning, curing and packing of fish, and large numbers of these travel from port to port from Scotland, down the East Coast, following the fishing fleets. During the season, therefore, the companies issue tickets to these workers at 25 per cent. below the ordinary fare upon surrender of an approved voucher. A similar concession is also given to fishermen travelling in connection with their work or to and from their homes. Turning from the professional to what may be termed the amateur fisherman, it is interesting to find that anglers are encouraged to ply their piscatorial art by the grant of return tickets at the single fare upon production of a membership card of a recognised anglers' club or association but, in order that there shall be no mistake as to the intention of the anglers, the regulations naively require them also to produce a fishing rod or line or, alternatively, an authorised form of voucher. The companies also treat shipwrecked mariners sympathetically and these are carried for single journeys at half the ordinary fare upon presentation of a voucher signed by an agent of one of their societies. Considerable additional traffic has been gained by the issue to sports clubs of return tickets at the single fare, conditional upon a minimum issue of 200 tickets annually by the club for use by their members and families in travelling to and from club grounds or sports grounds. Walking and cycling tourists, including campers, hikers, members of the Youth Hostel Association, and others, are assisted in their travels by the issue of single tickets at two-thirds of the ordinary fare from point to point, these being granted by pre-arrangement or upon surrender of a voucher recognised by the companies. This arrangement is of value because it enables passengers to travel out to one station and return from another. Other reduced fares are given in connection with travel to conferences, which are now held by a remarkably large number of organisations, and for parties. In addition to the usual arrangements, special concessions are made for ships' crews, workers on the land, rangers and rovers and others. While the total traffic carried under these arrangements may only reach a fairly small percentage of the passengers carried at reduced fares, there is no doubt that the facilities are of very great assistance to those concerned.

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Australian View of South African Railways

ON September 29, Mr. Edward Simms, M.Inst.T., Secretary of the Commonwealth Railways, read an address before the Institute of Transport in Sydney, entitled " Transport in the Union of South Africa with particular reference to the railways." Mr. Simms visited South Africa in 1937 at the request of the Commonwealth Government. The first important point he makes is that the railways in the Union are essentially a transport rather than a railway undertaking, operating very extensive road services, all the scheduled air services, and their own steamships as well as constructing, controlling, and maintaining the harbours. As comparing favourably with Australian conditions, Mr. Simms points to the lack of competition by sea, advantages of being permitted to run road services, and uniformity of gauge. He further stresses the importance of unity of control of railways and harbours, and remarks that in 1937, Durban alone handled over 5,000,000 tons, a tonnage approximating to that of Melbourne, and greater than that of any other Australian port. Durban has no fewer than 85 electric cranes, and its mechanical coaling plant is capable of loading bins at the rate of 400 tons an hour or of off-loading 300 tons an hour. The terminal grain elevator has a storage capacity of 42,000 tons, and an intake or shipping capacity of 1,000 tons an hour; the 1,150-ft. graving dock is also mentioned. Other harbours also are excellently equipped on similar lines.

Financially, Mr. Simms calls attention to the fact that the S.A.R. & H. administration was able to write off over £1 million of railway capital from surplus earnings last year, and used £1,850,000 for elimination of level crossings and other improvements. Surplus earnings also provided £2,850,000 for the Depreciation Fund. In the latter connection he considers the administration provides an object lesson, as from ordinary votes it applies some 7½ per cent. of the earnings, and for some years past has been supplementing this provision annually. In 1937-38 £5,400,000 in all were put aside as depreciation for renewals of locomotives, rolling stock, permanent way, road vehicles, &c. Of the £1,705,000 actually expended on rolling stock during the year only £1,120 came from capital funds, the whole of the remaining £1,704,000 being met from Depreciation Reserve Fund. The great advantages of being able, in this way, to keep abreast of the times by purchasing modern rolling stock and other equipment and discard obsolete material appealed to Mr. Simms, as contributing greatly to the success of the undertaking. On the other hand, he expresses surprise that a country containing only 2,000,000 white and 7½ million coloured people should have a railway system capable of carrying such large revenues, and that the traffic offering should be so great. He attributes this happy state of affairs to five principal conditions: (1) A period of marked prosperity due to inflation in the price of gold, (2) long hauls by rail, (3) a Transport Act recognising the railways as the transport system of the Union, (4) the roads not

being so good as to encourage private motor car competition, as in Australia and other countries, and (5) industrial conditions permitting of the employment of a large percentage of the staff at a very low wage. In the latter connection he points to coal, mined by coloured labour, costing on an average only about 5s. 6d. a ton.

Mr. Simms then passes on to enlarge upon the comfort of travel in the Union, the speed, especially considering the 3 ft. 6 in. gauge, the excellent dining car service and the special training of the dining car staff, and the moderate sum of 3s. a journey charged for bedding service, even over journeys occupying more than one night. Another fact that struck him was the standardisation of 96-lb. rails for the principal main lines, 1,500 miles of which are now laid with them. The very powerful locomotives also impressed him. Other matters upon which the address dwells are road services and the Transport Act; these we are dealing with in our next Road Transport Section. In conclusion, Mr. Simms expresses the view that, in spite of its obvious difficulties, such as the dual language problem, and its political troubles, the S.A.R. & H. administration " is carrying on a wonderful work in the interest of the nation "; its story is, he considers, " a romance."

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The Spanish Railways and the War

SINCE the outbreak of the civil war in Spain, very little information has been published as to the position of the Spanish railways and the influence of the war on their operation and general condition. The whole system is some ten thousand miles in length, of which, prior to the war, 6,620 miles were owned and worked by four companies, and the remaining mileage distributed among a number of smaller concerns. Of the four principal companies the Northern, and the Madrid, Zaragossa & Alicante, owned about 2,200 miles each, the National Western (guaranteed and partly owned by the State) 990 miles, and the Andaluces (which was taken over by the State early in 1936) 1,030 miles. Now the position is that about two-thirds of the whole mileage is in the territory controlled by the Nationalist Government. About three-quarters of the Northern Company's lines are in Nationalist territory, and nearly all the National Western and Andaluces lines. The Madrid, Zaragossa & Alicante Company's lines are mainly in Republican hands. The Northern, M.Z.A. and National Western Companies, whose head offices were in Madrid, have constituted provisional administration headquarters in Valladolid. Railways in Nationalist territory are being worked under their respective concessions and under the old railway law (subject in some cases to the statute of 1924), but on the Republican side all the railways, which were taken over by the workers' committees on the outbreak of war, have been nationalised and are operated as a whole by the National Railway Council.

As regards present conditions, not only has the Nationalist Government the advantage of the greater length of line, but it is in possession of the fuel supply, as practically all the Spanish bituminous coal is found in Asturias. The Republican railways are therefore dependent, except for the inferior coal of Puertollano and Gerona, on imported fuel. As regards the electrified lines the position is similarly unequal, since the Nationalist forces cut off the main power supply at Tremp reservoir. This vital condition of fuel supply has been responsible for a general and severe restriction of rail transport in Republican territory. Service on many lines is limited to military transport, and in others, such as that between Barcelona and Lerida, and Barcelona to the frontier, one passenger train a day is being run. Even where oil-fired railcars are running there are severe restrictions. In Nationalist territory working conditions are much more favourable. There is no fuel problem, and the principal difficulty is rather one of bringing the lines up to such a standard as will enable them to deal with a greatly increased traffic, since in addition to the increased ordinary traffic there is now military transport.

The Spanish railway system grew naturally on a radial principle with Madrid as its centre, and the possession by the Republican forces of the capital, with its through trunk lines, has left the Nationalists with only one line of communication between the important centres of Salamanca and Seville. This single track line carried a very small and slow traffic before the war and only now is it gradually being capacitated to deal with the heavier and faster service required by civil and military communication between the north and south official centres. Even so the congestion at both ends is still a formidable problem. On the other hand all the railways in the north, which had suffered severe damage during the fighting in that region, have now been repaired and are working normally. The increase in traffic is indicated by the fact that the receipts of the National Western and Andaluces systems nearly doubled in the last half year of 1937, as compared with the previous corresponding period. Meanwhile the Minister of Public Works of the Burgos Government has been authorised to budget for a very considerable outlay on renewals of track and rolling stock (particulars of which were published in THE RAILWAY GAZETTE of April 8 and May 13 last) and a special commission has been appointed by General Franco to consider the railway problem as a whole (as already reported in THE RAILWAY GAZETTE of August 19) with a view to the possibilities of a consortium between the State and the companies, and a scheme of co-ordination with road transport.

LETTERS TO THE EDITOR

(The Editor is not responsible for the opinions of correspondents)

Timetables

" The Woonsocket Call,"
Rhode Island
September 20, 1938

TO THE EDITOR OF THE RAILWAY GAZETTE

SIR,—The editorial comment in THE RAILWAY GAZETTE for August 19 on " Timetables " was especially interesting to me, since for many years my hobby has been that of collecting timetables and other railway material. Though I have never been a railwayman, I subscribe to THE RAILWAY GAZETTE, *The Railway Magazine*, and our American paper the *Railway Age*. May I recommend to the writer of your article a careful perusal of the recent article in *Typography* (London) by Christian Barman entitled " Timetable Typography "? I regret that I cannot give the date of issue—I have only a photostat of the article, which does not show that date.

Mr. Barman calls the German *Reichskursbuch* the " most complete, the best edited and best printed " timetable available. He states that, in a smaller way, the Swiss *Amtliches Kursbuch* is excellent. He approves on the whole of the L.P.T.B. timebooks as changed in 1937 He is inclined to agree with your writer that English timetables are unnecessarily complex. He writes, of course, from the point of view of a typographer. My business, as you can see from the letterhead, requires a superficial knowledge of printing technique and typography, although my own duties

have nothing directly to do with typesetting or printing. The British timetable, to me, is too bulky. G.W.R., L.N.E.R., L.M.S.R. are too large, S.R. too fat. Even the condensed timetables are anything but clear—the best place to get a quick picture of the London—Scotland service, for instance, is in the section of the *Reichskursbuch* devoted to England. Consist tables, such as your writer approves in the *Indicateur Chaix*, are absent from British timebooks. I question the necessity of a complete recitation of rules and regulations. The pocket timetables are perhaps too small to give reasonably full information.

Perhaps the easiest-read timetable in the Empire is the Victorian Railways folder as rearranged a few years ago. To me it seems to combine the good features of British and American timetables. The folder style is easier for the pocket or desk than book-style. Printing is fairly good, though a more legible type is possible. The map is good. Other Australian timetables are likely to be over-bulky. The South African timetable, since the sectional maps have been taken out, seems to have lost a valuable aid to reference. While Argentine timetables are clear and simple, they too lack consist tables in many cases. Brazilian and Uruguayan seem not quite as readable as the Argentine. The Kenya & Uganda timetable, save for the same lack of consist tables, is fine.

The use of conventional signs, recommended by your writer, is a great aid. For this reason, the Southern *Continental Handbook* is perhaps the most readable of English schedule books. I confess to a liking for the 24-hr. system (used in North America, as far as I know, only in the working timetables of C.P.R. and C.N.R. Western districts). I have purposely not discussed American timetables, as I see too many of them to assay them properly, I think. The American *Official Guide* is necessarily very bulky, but is rather easy to read—the use of conventional signs like the bed for sleeping cars and the crossed knife and fork for dining cars would help, I think. Timetables of large American lines invariably carry condensed schedules in the front of the timetable—either with the schedules of the various lines, like B. & O., C.M.S., P. & P., C.B. & Q., and some P.R.R., or separately just after the schedules like N.Y.N.H. & H., N.Y.C., C.R.I. & P. The Pennsylvania uses both systems in various timetables. The Roumanian and Jugoslav guides are simple and easy to read. I particularly like the diagrams of consists of important trains in the Netherlands timetable.

For the purpose it is to serve, I think that the *Orario Internazionale* of the Italian State Railways is perhaps as clean and clear a timetable as I have seen. Printing and arrangement are novel and simple. It contains postal and passport information in condensed form, has pictures and is generally attractive. However, it is much more elaborate and expensive than a timetable for general circulation could ever be. The fact that it carries comparatively few schedules, with those listing only the most important trains, gives an opportunity for clarity and good appearance that a general timetable must necessarily lack.

Railway officials all over the world have been kind to me. My remarks, I trust, will not be considered other than in the light of constructive criticism. Change of format in such timetables as the *Reichskursbuch*, the G.W.R. general timetable, or the *Indicateur Chaix* is tremendously expensive. It is probable that, in most of the cases I cite, the cost of improving typography and arrangement would be all out of proportion to the benefits to be derived by the searcher for railway information. I trust that your writer (and your readers, should you see fit to publish this) may derive some benefit from my animadversions on timetables in general and in particular.

Yours very truly,

PRINTER

P.S. I note, in rereading, that I have failed to comment on the *Indicateur Chaix*, which received so much of your writer's attention. The arrangement whereby separate sections are printed for the different regions (formerly railways) is admirable. The type and footnotes are well done, as your article states. My chief criticism is the lack of more than the barest schedules of international trains—and to be truthful, my feeling probably arises more from my disappointment at not seeing them there than from any belief they belong in that book. I'd rank the *Indicateur* fourth among European timetables, I think, with the *Reichskursbuch*, the Swiss *Amtliches Kursbuch*, and the Italian international timetable mentioned as first, second and third.

Early Timetables

60A, Green Lane, Northwood,
Middlesex, September 28

TO THE EDITOR OF THE RAILWAY GAZETTE

SIR,—As considerable interest is being taken in Drake's maps and timetables published in Birmingham a century ago, perhaps it may be of interest to say that I have been able to trace and to obtain particulars of an earlier issue than the two marked on their titles " new edition corrected to October, 1838," and " November, 1838," respectively, referred to by myself in your correspondence columns a short time ago.

Aris' Birmingham Gazette of July 23, 1838, announced as " Just published, Drake's Railroad Maps of the entire route from London to Liverpool and Manchester, beautifully engraved and coloured and extending many miles on each side of the line; ornamented with views of the Euston Grove station, in London, and a complete train of carriages. With the rules, regulations, fares, times of outset and arrival of the trains at the various stations together with all requisite information for travellers. Price on canvass, in a case for the pocket, 2s."

The advertisement stated that James Drake, of Birmingham, was the printer and publisher. *The Midland Counties Herald* of August 2 had a short editorial notice of the publication. A copy of this, obviously the first issue, was exhibited in the Science Museum, South Kensington, in 1925, and appears on page 76 of the catalogue, Land Transport (Railway Construction and Working), published in 1927—" Drake's Time Tables and Maps, 1838. Lent by A. Titley, Esq., 1925." The owner has very kindly sent me particulars. The title agrees exactly with the advertisement quoted above, and the time sheet showed the coach connection between Denbigh Hall and Rugby covering the gap on the London and Birmingham line prior to September 17, 1838. The title, unlike that of October and November, has not the words *New Edition*.

This was certainly the original issue, advertised in *Aris' Journal* of July 23 as " Just published," and reviewed ten days later in the *Midland Counties Herald*.

Your obedient servant,

REGINALD B. FELLOWS

London & Birmingham Railway Centenary

A total attendance for the week of approximately 28,000 was recorded at the " Century of Progress " exhibition held by the L.M.S.R. at Euston station from September 19 to 25, to commemorate the centenary of the throughout opening of the London & Birmingham Railway.

What is believed to be the first excursion train ever run to Euston from south of the Thames brought 300 schoolboys and from 100 to 150 teachers and parents to visit the exhibition on Saturday morning. The object of the journey was to give the boys, pupils of the Abbey and Clare House Schools, Beckenham, a practical combined lesson in London geography and in railway history. The special train left Beckenham Junction (S.R.) at 9.5 a.m. and, travelling round London by way of Herne Hill, Clapham Junction, Kensington, and Willesden Junction, reached Euston about 10 o'clock. After inspecting the exhibition the boys returned in their special train.

On Sunday last the L.M.S.R. afforded facilities to a party of railway history enthusiasts, chiefly members of the Railway Club, to visit the old London & Birmingham Railway terminus at Curzon Street, Birmingham. Local representatives of the company explained various features of interest, and the members of the party were thus able to begin the week of celebration at the Euston terminus and to finish it at the original Birmingham terminus.

PUBLICATIONS RECEIVED

A History of British Railways Down to the Year 1830. By C. F. Dendy Marshall. London: Oxford University Press, Amen House, Warwick Square, E.C.4. 11¼ in. × 7½ in. × 1½ in. 246 pp. + plates. Price 38s. net.—Railways have proved a source of inspiration to many authors and have resulted in the production of a very considerable library of specialised books, but there are still a number of virtually unexplored fields and one of these has been selected by Mr. Dendy Marshall as the subject of this volume. Until its appearance, there have been only two books dealing at all comprehensively with British railway history before 1830, namely, the late Mr. Henry Grote Lewin's "Early British Railways, 1801-1844" and the present reviewer's little volume, "The Evolution of Railways." The former limited its scope to railways of the nineteenth century and also confined its attention to those lines which were incorporated by Act of Parliament; while the latter book dealt primarily with track and its forms. In a large measure, therefore, Mr. Dendy Marshall has covered new ground, and the result is the production of a volume which it would be difficult for any future railway historian to ignore.

Chapter I, entitled "The Beginnings of the Railway," defines the subject as follows: "The conception 'railway' contains three elements, (1) the wheel, (2) a prepared track, (3) means for lateral constraint of the motion." With the first two features the author does not deal, as he remarks, not without truth, that their origins are lost in antiquity, and of (3) he says the result of modern research is that the date of the introduction of this element of railway transport goes farther and farther back into the past. Mr. Dendy Marshall takes up his story with the earliest known illustration of a truck running on a railway—that in "Der Ursprung gemeynner," to which he assigns the approximate date of 1530. He then reproduces the more or less similar illustration from Münster's "Cosmographia" of 1550, (unfortunately copied from a work of 1935 and not from the original, with the result that much detail is lost). Then follows the well-known illustration from "De Re Metallica," all tending to show that the essentials of the mining railway were known in mediæval Germany. The remainder of the chapter is concerned with the first-known railways in England and with the contemporary authorities upon which our knowledge of these is founded. In connection with this early material the author calls attention to "The Evolution of Railways" and says that the very close correspondence between the early records it contains with those comprised in Chapter I of the present work encourages the hope that the material available has been thoroughly sifted, in view of the fact that both researches were independent of one another.

A prominent feature of Mr. Dendy Marshall's book is the large proportion of quotations, and in the preface he says that an unkind critic might liken his work to a collection of newspaper cuttings. The critic who took such a step would be not only unkind, but also foolish, for one of the greatest merits of the present volume is the fact that where evidence exists for statements it is invariably quoted. As the author says, if his book had been written in the old-fashioned way, with all the information paraphrased and cast into a continuous narrative interspersed with the author's own ideas and comments, a more readable volume might have been produced, but the serious student would have had no means of knowing whether any particular passage was merely a guess of the author's or was based on a contemporary source.

After the preliminary chapter, with which we have just dealt, there are five describing the railways of Great Britain in geographical groups, respectively, the North of England; the Midlands; the South of England; Wales; and Scotland and Ireland; then follow two chapters giving technical detail of construction; one setting forth interesting passages from writers who at the inception of the nineteenth century had begun to foresee what railways might become; one dealing with the Stockton and Darlington; and one with the Liverpool and Manchester Railway. Chapter XII consists of some useful bibliographical notes, mainly supplementary to those included in Mr. R. A. Peddie's "Railway Literature, 1556-1830." A few of the notes indicate mistakes of Mr. Peddie, some mention omissions, and others give more detailed particulars of interesting items. The index and glossary deserves very special mention, as it is not only the key to the whole book, but also contains a considerable amount of information not included in the main volume.

In one or two respects the author has made peculiar deductions from his material, as, for example, when he speaks (on page 145) about the introduction of iron rails and says that the rails introduced by John Curr at Sheffield about 1775 were no doubt of wood. Curr, in his well-known volume, "The Coal Viewer," published in 1797, said "the making and use of iron railroads were the first of my inventions, and were introduced at the Sheffield colliery about twenty-one years ago." This takes the date back to 1776, but Mr. Dendy Marshall mentions that he possesses a copy of "The Coal Viewer" dated 1796 (believed to be the only copy of this date) and from this he arrives at the date 1775 for his *wooden* rails. The present reviewer has not seen the copy in question, and the wording may be slightly different, but the ordinary copies published in 1797 seem to leave little doubt that it was at least as early as 1776 that John Curr introduced *iron* rails.

The author does less than justice to the results of his own research in regard to what was called the "double road," namely, an easily-renewable timber rail fixed to a more permanent longitudinal. On page 139, he says that it is not possible to find the date when, or the place where, the additional rail was first laid on the top to take the wear, and adds that John Buddle's account of 1807 "is the earliest mention of it, so far as the author knows." Nevertheless, in the course of his researches, Mr. Dendy Marshall has actually come across an earlier mention and quoted it some pages earlier in the present volume. On page 122, he quotes from "The Statistical Account of Scotland," 1793, which refers to the renewing of the old Alloa wagon-way in 1785. That account says, "the sleepers are very broad . . . a rail of foreign fir, 4 in. square, is pinned down to them, and another rail, of the same dimensions, is laid over it." These are comparatively minor imperfections, however, in a very fine and well-produced volume.

All those interested in research into the subject of very early railways will doubtless be grateful to Mr. Dendy Marshall for having made so readily available the results of his own work. Furthermore, this book provides a starting point for further effort, as a careful reading of its pages indicates clearly how much is still obscure. All over the country there are or have been early railways—many of them of considerable historical interest—that have escaped description in any available published work. Perhaps in the light of Mr. Dendy Marshall's book, possessors of private diaries and unpublished local records may come forward with new references, of which previously the importance may not have been appreciated. We have no hesitation in commending Mr. Dendy Marshall's volume as an indispensable work to all interested in the period which it covers.

CHARLES E. LEE

Machinery and Equipment used for Bending Wood. By W. C. Stevens, M.A., A.M.I.Mech.E. Department of Scientific and Industrial Research Forest Products Research Records—No. 25. London: H.M. Stationery Office, Adastral House, Kingsway, W.C.2. 9½ in. × 6 in. 13 pp. Price 6d. net.—The general principles and methods of bending solid wood were discussed and defined in a previous publication entitled "The Practice of Wood Bending" (Forest Products Research Record No. 10), and the manner in which these principles can be applied to such bends as are made by hand was dealt with in F.P.R. Bulletin No. 17, "Methods of Bending Wood by Hand." The present record outlines and describes the various equipment in general use for bending wood by means of power-driven machinery.

XUM

THE SCRAP HEAP

OVERHEARD AT A LONDON TERMINUS ON THURSDAY

Irate Passenger (In exodus from London): "I've booked a ticket and can't get a seat. Who's responsible for all this muddle and confusion? I want to see him.

Ticket Collector: Hitler.

* * *

One of the locomotives of the Southport 15-in. gauge passenger-carrying railway was badly damaged by a fire that broke out in the engine shed on September 16. The other engine in the shed, *Princess Elizabeth*, was pushed out to safety by the firemen. This miniature railway has been in operation for 27 years.

* * *

CANDID CONFESSIONS—NO. 63, MR. J. SMITH

Which is your favourite railway station?—The one I have never been to.

What is your pet aversion?—People who loll about in corridors.

What is your favourite hobby?—Studying the bye-laws and regulations.

What is your earliest recollection?—Being hidden under the seat by father. —*Punch.*

* * *

The navvies engaged in the construction of the Vale of Neath Railway in the early 'fifties must have been an unruly lot. Not only did they unpoise the fine logan stone of Pont-Neath-Vaughan but they had the audacity when their Christmas beef had become scarce to take a heifer from Ty Sieffra hard by and kill it to supply the deficiency.—*From the "Western Mail."*

* * *

RAIL "TONIC" TRIPS

A programme of 350 excursions—end of the season rail travel bargains—has been arranged by the Great Western Railway for the next few weeks. There will be "tonic" trips to the seaside from the big centres, and "autumnal tints" trips to inland beauty spots, including rail and river trips to the Thames Valley. A large number of these excursions will be run on Sundays at fares as low as 3 miles a penny. From the provinces excursions have been arranged to London and other big cities in connection with shows, exhibitions, fairs, and such events.

* * *

A POLICEMAN BETWEEN

The offices of the German State Railway and the Czechoslovak Travel Bureau are next door to each other in Regent Street. For the past week a policeman has stood significantly in the little space separating the two. The window displays fishing tackle and proclaims: "Fishing in Czechoslovakia." The other shows bunches of grapes and models of wine barrels with the invitation: "Germany for happy holidays." Few of the thousands of people who pass the two offices daily and who wait for buses outside seem to notice anything curious in this proximity, but the policeman remains there night and day. —*From "The Manchester Guardian."*

* * *

Just before the train started a boy ran up to the ticket inspector and whispered: "Sir, there's two men on that train without tickets."

The inspector searched the carriages in vain, and then seeing the informer standing near, enquired: "Where are they?"

"On the engine!" replied the boy, making rapid tracks for the exit.

* * *

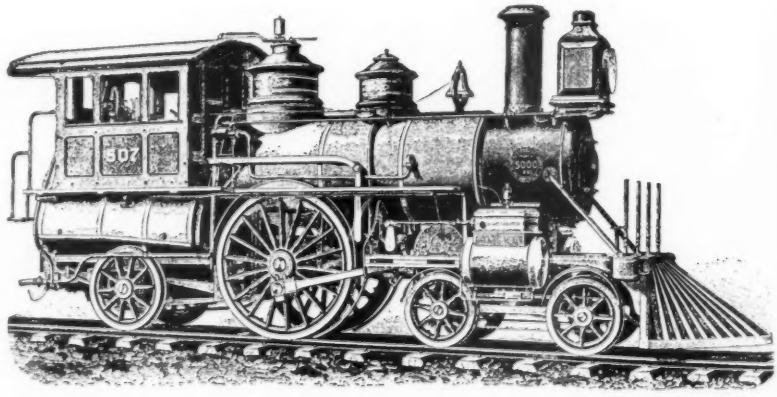
The vital necessity for the Nationalists was to keep the railway lines open to Vigo and pour through the country the millions of gallons of petrol needed to keep the war machine going. The Madrid syndicates had ordered a general strike and this was being fully applied by all the railway workers. General Mola rushed out a decree bearing his signature ordering everybody back to work under the dire penalty of instant execution under the code of martial law in the event of disobedience. The question was: would the workers obey, and, in the confusion of civil war, could sufficient goods trains be formed and run between Burgos and the western ports? For it was known that the supply of petrol in the country was insufficient for the huge demands of the army motor transport first, and secondly, for the growing and insatiable consumption of the air force. General Mola, however, not content with issuing his decree, appointed a small technical committee of railway engineers to whom he gave military rank and power, while the Civil Guard in all the territory under Nationalist control were set to the task of routing out all the railway workers and serving on them orders to start work at once. Twenty-four hours later the trains were running, and the first I saw, slowly climbing the steep gradient which leads from Briviesca to Burgos, was an immense train composed solely of petrol tanks. The situation was saved; petrol was being brought from the reservoirs of Vigo and Ferrol, and distributed throughout the country. . . .—*Condensed from "The March of a Nation," by H. G. Cardozo.*

* * *

"A new system for carrying on the (passenger) traffic with metal cheques" is referred to in *The Railway Times* of Saturday, December 4, 1841, by Thomas Riddell, Chief Booking Clerk at the Brighton, Croydon & Dover joint station, London Bridge. It seems that the Editor had in a previous issue assigned the merit of this system to "Mr. Pulford, Accountant to the Croydon Railway Company," and the injured inventor says, "I beg to inform you that I directed the attention of Mr. Pulford . . . not only to the principle of metal cheques, but also to a machine for registering the issue, a model of which I have had fitted up in this office. My attention was directed to this in consequence of the great expense incurred by using paper tickets, as well as to the objection of the public to their being so easily lost, thereby subjecting them to double payment. . . . I supplied the Croydon company with 10,000 cheques."

* * *

Some weeks ago we recorded the presentation by Sir Nigel Gresley on behalf of the L.N.E.R. to Mr. Richard Pennoyer of the American locomotive bell formerly used to summon the engine fitters to work at Hornsey locomotive depot. *The Mutual Magazine* (U.S.A.), in quoting the full story from our columns, has unearthed an old woodcut of the locomotive upon which the bell was originally mounted. This illustration, which we reproduce, appeared in *The Railroad Gazette* of New York in the early '80s.



Woodcut from "The Railroad Gazette" of New York showing the 5,000th engine built by the Baldwin Locomotive Works. The bell was afterwards used at Hornsey locomotive depot, and was recently presented to Mr Richard Pennoyer

OVERSEAS RAILWAY AFFAIRS

(From our special correspondents)

ARGENTINA

Wage Reductions on Central Argentine Railway

The Central Argentine Railway deferred taking the drastic step of introducing cuts in pay as long as possible, in the hope that the situation would improve sufficiently to render it unnecessary. But, in view of the continued decline in the receipts, which by the end of the seventh week of the new financial year already showed an aggregate decrease of nearly 4½ million pesos as compared with the corresponding period of 1937-38, the company had no other alternative. Accordingly it announced that, in view of the difficult financial situation, salaries and wages would be reduced in all departments by 3·3 per cent. as from August 1, except in the workshops and the Telegraphs and Signals Department, where a system of short time would be established. As in the case of the other railways which have been obliged to adopt similar measures to reduce working expenses, the deduction will be made in accordance with the conditions of the Presidential Award of October, 1934, which provided that such deductions were to be regarded as in the nature of temporary retentions, to be returned as and when circumstances permitted.

Grain Elevators Sanctioned

The construction of a number of terminal grain elevators at a cost of $9,183,000 paper, was approved by the Ministers of Finance and Agriculture on August 5. In addition, $4,104,000 will be spent on installations, and $6,500,000 on the expropriation of the necessary lands and buildings, making a total of $19,787,000. The scheme provides for the construction of elevators at Buenos Aires (2), Villa Constitución, Quequen, Ingeniero White, Rosario (2), La Plata, Concepción del Uruguay, Diamante, Santa Fé, San Nicolás, Mar del Plata, and Zárate, with a total capacity of 650,000 tons. The total cost is fixed at $65,000,000, including the 20 millions already sanctioned. Provision is also made for the supply of 100 loading cranes for use at railway stations and ports. It is proposed to erect in the first place elevators with a capacity of 5,000 tons each at termini where the movement of grain amounts to 25,000 tons and upwards.

Mountain Locomotives for State Railways

Fried. Krupp A.G. of Essen, Germany, was recently awarded a contract for supplying 10 Mountain type, metre-gauge locomotives, for the State Railways, of which six have already arrived, and will shortly be followed by the remainder. The locomotives arrived partly assembled, the boilers and water tanks being installed after discharge at the port of Buenos Aires. Subsequently they were hauled to the State Railway workshops at Laguna Paiva, Province of Santa Fé, where they were completed. Each locomotive has a tractive effort of 31,000 lb., and its cost is $123,000 Argentine paper.

BRAZIL

Madeira—Mamoré Railway

A telegram from Washington states that the men who took part in the building of the Madeira—Mamoré Railway, one of the most arduous South American railway engineering achievements of 25 years ago, will meet in New York and San Francisco on the occasion of the International Exhibitions to be held at these two places in 1939. The Madeira—Mamoré Railway, it will be remembered, has a length of 202 miles and joins up Porto Velho, situated at the source of the river Madeira, to Guajará-Mirim, on the river Mamoré. The object of the railway was to provide an outlet for the agricultural products of the fertile occidental region of Brazil, as also north-west Bolivia, avoiding the dangerous cataracts of the two rivers which made transport by water almost impossible.

The possibilities of constructing a railway were first discussed in 1864, but attempts made in 1871 were frustrated by the difficulties of working in the tropics, accentuated by the great distances from the centres of supply to the zone of operations. Only in 1907 was it possible to recommence operations, the last section being opened for traffic on July 15, 1912. It is said that nearly 14,000 men were employed on this construction, and many of the engineers, who then had just left school, are now eminent American engineers; it is to them that the Madeira-Mamoré Association owes its formation. All those who took part in the work between 1907 and 1913 are eligible for admission to the association under whose auspices the re-union in San Francisco and New York has been organised.

INDIA

Pacific Locomotive Committee

Members of the Pacific Locomotive Committee appointed by the Government of India to inquire into the design and purchase of "XB" and allied types of locomotive arrived at Bombay on September 1. In a press interview, the Chairman of the committee, Lt.-Colonel A. H. L. Mount, stated that two of the five members of the committee had never visited India before. The Chairman knew that in entering upon the investigation with open minds, the committee would have the fullest co-operation of everyone concerned on the railways of India. Colonel Mount and his colleagues were anxious to render all the assistance and advice they could, in solving a difficult problem which closely affected public safety in rail transport. One of the members, Mr. W. A. Stanier, came to India in 1936 with the Wedgwood Committee.

The new committee took up its work almost immediately, and, after spending two days in Bombay, proceeded to Raichur *en route* for Madras in a special train hauled by an "XB" engine. At Raichur, this engine was replaced by another of the same type. The performance of the engines was observed by the committee from the footplate. After discussing questions associated with the inquiry with the Agent and other officers of the Madras & Southern Mahratta Railway, the committee proceeded to Shoranur to meet and hold discussions with South Indian Railway officials. It is understood that the committee proposes to cover the main lines of railway in a tour of six weeks, examining engines both on the road and in workshops.

Purchase of South Bihar Railway

It is learned that the Government of India proposes to acquire by purchase next year from the owning company the 79-mile broad gauge South Bihar Railway, which runs from Luckeesearai to Gaya, stations on the East Indian Railway. The railway is now operated by the E.I.R., and, under the agreement between the Secretary of State for India and the company, the latter receives an annual payment of £30,000. It is provided that on the termination of the contract, the company will be entitled to a payment of £684,580, being the capital expended on the undertaking with the authorisation of the Secretary of State.

Cotton Freights to Cawnpore

Cawnpore is an important centre of the cotton textile industry, consuming about 300,000 bales of cotton, the bulk of which is obtained by rail from the Punjab. The Cawnpore Mills have long been demanding a reduction of freight on their imports of cotton as no other textile centre, in their view, paid such a high rate of freight. Failing to obtain a reduction, the Cawnpore textile interests brought some 25,000 bales of cotton from the Punjab by motor lorries during the cotton season of 1936-37, thus depriving the railways of revenue to the amount of over Rs. 2½ lakhs. It was then that the East Indian and North Western Railways agreed to grant a rebate of 25 per cent. on the existing freight, subject to a guaranteed minimum transport of 15,000 bales during the season. The concession was available from November 1, 1937, to August 31, 1938. The Chief Commissioner of Railways recently stated that it had not yet been decided whether the rebate would be continued, suggesting at the same time that if a higher-rated commodity like cotton, was diverted to the road, the railways would have to meet the loss of traffic by increasing the freight on

low-rated commodities like coal. Intriguing as the situation is, the Great Indian Peninsula Railway has introduced a further complication by reducing the cotton freight from Ujjain to Cawnpore by a substantial percentage, both to meet road competition and to capture the Cawnpore cotton traffic.

PARAGUAY

New International Lines

Telegraphic news from Asunción states that ways and means are being studied to finance the construction of a railway from the city of Concepción to a point on the Brazilian line from Santos to Bella Vista. A connecting line would be one from Concepción, crossing the Chaco to Camiri in Bolivia and joining up eventually with the Argentine State Railways somewhere in the Province of Salta.

It is also stated—with what authority is not known—that the respective Governments concerned are interested in the construction of these lines at an early date.

CEYLON

No Fourth Class on Government Railway

The Executive Committee of Communications and Works has rejected the suggestion for a fourth class on the Government Railway, in view of the fact that the railway authorities propose to improve the third class carriages by introducing several conveniences such as improving seating accommodation. The question of providing a fourth class arose as a result of a motion in the State Council.

Railway Bid to Capture Fish Transport

More fresh fish is now being marketed in Colombo as a result of the keen competition in its transport by rail and lorry. The railway has accelerated the arrival of the fish by delivering it by lorry, on arrival by train, straight to the markets in the city. The construction of refrigerator vans for the transport of fish by train, which is in contemplation, is expected to bring more traffic to the railway.

UNITED STATES

New Streamline Locomotives for C. & N.W.RR.

During the spring of this year, the American Locomotive Company delivered to the Chicago & North Western Railroad nine new heavy 4-6-4 locomotives. Eight of them are in regular use hauling the San Francisco and Los Angeles Challenger expresses, the San Francisco Overland Limited, and the Pacific Limited on that system, the ninth engine being spare for special workings. Thanks to their greater coal and water capacities, these engines are able to complete the run between Chicago and Omaha with three fewer intermediate stops than the older locomotives, and the nine new ones are now averaging about 14,000 miles a month, handling trains varying from 10 to 18 passenger and Pullman cars. The following are their leading dimensions :—

Cylinders (two)	25-in. dia. by 29-in. stroke.
Piston valve dia.—	
7 engines, 12 in. / 2 ,, 14 in.	by 7¾-in. max. travel.
Coupled wheel dia.	7 ft. 0 in.
Boiler, min. dia.	7 ft. 4 $\frac{5}{16}$ in.
Length between tube plates	19 ft. 0 in.
Pressure	300 lb. per. sq. in.
Grate area	90·7 sq. ft.
Heating surface—	
Firebox total	507 ,, ,,
Tubes and flues	3,472 ,, ,,
Evaporative total	3,979 ,, ,,
Superheating	1,884 ,, ,,
Combined evap. and superheating	5,863 ,, ,,
Tractive force at 85 per cent. boiler pressure	55,000 lb.
Weights—	
Adhesion	108 tons.
Total engine	206 ,,
Tender	180 ,,
Total e. & t.	286 ,,
Tender capacities—	
Water	20,000 U.S. gal.
Coal	22¼ tons.
Wheel bases—	
Coupled	14 ft. 8 in.
Engine total	42 ft. 4 in.
Engine and tender	89 ft. 0 in.

A good deal of nickel steel is used in the boiler, the inside throat and back tube plates of which are welded, as are also the firedoor opening plates, and 12-in. lengths at each end of the longitudinal seams of the barrel. There is a brick arch supported on two arch tubes and two Thermic syphons in the firebox. A standard BK automatic stoker is fitted. A.S.F. roller bearings are fitted to the leading engine and to the tender bogies, and the engine trailing bogie and the coupled axles are equipped with Timken roller bearings with one-piece housings; the trailing engine bogie is designed so that it can be fitted with a booster at some future date, if desired. The connecting and coupling rods are of nickel-carbon steel, normalised, quenched, and drawn, and have floating type bushings. Steam distribution is by Baker valve gear with Barco type M-I power reversing gear. The tender which is carried on two 6-wheel bogies is of the rectangular pattern. These engines are among the largest of their type yet built, according to the *Railway Age*.

IRAN

Further Details of the Trans-Iranian Railway

It is estimated that 73 per cent. of the total length of this line is in mountainous terrain, only 27 per cent. being in easy plains country; and 95 per cent. of the 40,000 to 50,000 men employed were Iranians. Some 98 tons of dynamite were used each month during construction. There are 92 tunnels on the northern section between Bandar Shah and the crest of the Elburz mountains, including the 2¼-mile summit tunnel; and, including the descent thence, to the central plateau, there are over 14½ miles of line in tunnel and 1,933 bridges and viaducts.

On the southern section there are 131 tunnels, the longest over two miles in length, and 2,839 bridges, the longest, over the Karun river, having 51 spans. According to a Reuters message a British firm of consulting engineers has been appointed by the Iranian Government to inspect and pass all materials and certify that all rolling stock and other equipment conforms to specification.

SPAIN

Railway Commission

The Burgos *Boletin Oficial* of August 22 contains a notification appointing the following as members of the Railway Commission authorised by the Order of July 9, already reported in THE RAILWAY GAZETTE of August 19 last as having been promulgated. The President is the actual head of the National Railway Service, Señor Eugenio Calderon Monteros-Rios. The members representing the Railway Department are Engineers Alfonso Jaraiz and Federico Valenciano; member representing the Service of Co-ordination of Road Transport, Sr. Miguel Martinez; for the Military Services, Engineer Rafael Rubio, and representing the Ministry of Industry and Commerce, Sr. Manuel Casanova. The Ministry of Finance nominates Sr. Luis Saiz de Ibarra and there are, in addition, two financial experts, Professor Luis Olariaga and Sr. Ramon Berge, with Sr. Pablo Martinez.

The members of the new commission held their first meeting at Santander on August 25, under the presidency of the Minister of Public Works, who explained that the Government instructed the commission to make a comprehensive study of the whole problem with a view to an equitable and permanent solution.

SWITZERLAND

Safety Secured by Rock Blasting

A large-scale rock blasting operation was undertaken in May last near Niederried, on the shores of the Lake of Brienz, to remove a danger threatening the Interlaken—Brienz section of the Brünig Railway and the main highway nearby. Falls of stones and rock had occurred at that point and interrupted traffic. As it was found that another piece of fissured rock of about 500 cu. m. (654 cu. yd.) was threatening to fall, it was decided to blast.

The work was entrusted to the Steinbruch Company of Oberhofen, under the supervision of the engineer to the canton of Berne, 49 holes were drilled in the rock up to 19 ft. 8 in. deep, and filled with 350 kg. (772 lb.) of Telsit, with duplex electric detonators. Firing took place on May 17, and the rock was blown into a cloud of small fragments incapable of doing appreciable damage.

REPRODUCING THE WEARING QUALITIES OF EARLY STEEL RAILS UNDER MODERN CONDITIONS

Summary of a paper entitled "The Exceptional Wearing Properties of Early Steel Rails and Their Reproduction in Modern Rail Manufacturing Conditions," by Mr. Cecil J. Allen, Technical Assistant, Engineer's Department, Southern Area, L.N.E.R. It was presented and discussed on September 21, at the Fourth International Rail Congress at Düsseldorf

The paper describes three stages by which the physical properties of steel rails in Great Britain have been materially improved during recent years—the substitution of a medium manganese for a high carbon composition, the introduction of controlled cooling, and the development of heat treatment. The average figures in this paper showing the respective effect on the tests of increased manganese and of controlled cooling are the first of their kind to be published.

SOME years ago it was a commonly expressed criticism in Great Britain that the rails then being manufactured were inferior in their wearing capacity to the rails produced in the earliest days of steelmaking. It was realised that the inferiority of the later product could not be explained entirely by the great increase in the weight, speed, and frequency of the trains that had taken place in the interim. The early rails had the advantage of lower rolling temperatures, and especially of lower finishing temperatures, which meant a very gradual reduction of the ingot during rolling; on the other hand, their content of sulphur and phosphorus was high, in comparison with present standards, and the carbon was generally low. In 1931 the Southern Area of the London & North Eastern Railway conducted an investigation into the chemical and physical properties of certain rails which had been continually in use from 42 to 51 years in secondary tracks (the results of which were set out in an article in the January, 1932, issue of *The Railway Engineer* by Mr. R. J. M. Inglis, then Permanent Way Engineer, Southern Area, L.N.E.R.). Of these rails the most noteworthy feature was found to be a hardening of the running surface; and the conclusion reached was that when these rails were laid, they were sufficiently in advance of the traffic conditions of their time to work-harden on the running surface, and this work-hardening provided a valuable protection against abrasive wear in the later years of their life, when the traffic was becoming heavier and faster. The principal lessons of the research were that the later trend in rail manufacture towards higher carbon percentages, and lower sulphur, phosphorus, and manganese, had been without justification from the rail wear point of view; also that the type of rail now to be sought was one still sufficiently in advance of present-day traffic conditions to be similarly capable of work-hardening in the earlier years of its life. But even if the early steel compositions could be reproduced, with modern methods of steelmaking, it is doubtful if they would stand up to the physical tests now demanded, and to the falling weight test in particular, if modern mill practice were followed in rolling the rails, while to restore, in these days of mass production, the rolling temperatures and the work done on the steel in earlier days, might quite conceivably prove a remedy more costly than the disease of unduly rapid wear which it is sought to cure.

These conclusions had been supported by the experience of the L.N.E.R. with steel rails made to the British Standard Specification for Rails of 1922. Owing to the almost complete substitution in Great Britain of open-hearth basic for Bessemer acid rail steel production after the war period of 1914-1918, the change was utilised to specify a steel containing 0·55 to 0·65 per cent. of carbon instead of the previous limits of 0·35 to 0·50 per cent., but with severely limited sulphur and phosphorus (0·05 and 0·04 per cent. maximum respectively with basic open-hearth steel), and manganese restricted to a maximum of 0·80 per cent. in order to avoid the brittleness that might be caused by an unduly high combination of carbon and manganese. Although considerably harder than before, these rails, with the additional disadvantage of high modern rolling and finishing temperatures, were found to have a coarsely crystalline structure that tended to grind or powder away under traffic, and it was on their inadequate wearing capacity that the criticism of past versus present has doubtless been chiefly based.

In 1931 the London & North Eastern Railway, after experiments on the Southern Area which showed in particular the loss of wearing capacity which had been experienced by cutting down the manganese percentage, introduced a new rail specification in which the carbon, in the open-hearth basic process, was reduced to limits of 0·50 to 0·60 per cent., but manganese was increased, a minimum of 0·90 per cent. being demanded, with a maximum of 1·10 per cent., since increased to 1·20 per cent. These limits of 0·90 to 1·20 per cent. of manganese were also standardised in the British Standard Specification for rails of 1935, which is now in general use by British railways. The maximum limits of sulphur and phosphorus were also relaxed on the L.N.E.R. Southern Area to 0·06 per cent., it being hoped that the slight increase in the phosphorus percentage might prove of some assistance to wear. It was anticipated, further, that the increased percentage of manganese, in view of the well-known properties of that element in "healing" the rolled surface of the steel, would give a better finish, and so reduce the rejections of the rails for skin defects, and this has proved in practice to be a correct forecast.

In Table A details are given of the improvement in physical properties of the rail steel that has resulted from the change-over from high carbon to medium manganese composition. While the average breaking strength of the steel has been maintained or slightly increased, the elongations and reductions of area, giving evidence of the relative toughness of the steel, have increased considerably, and the beneficial effect of the manganese is evident in the improved microstructures of these rails. In this table, analyses and tests have been averaged over considerable tonnages of rails, with no omissions, and therefore fairly represent normal practice, rather than a selection merely of the best results. From this table it will be seen that, as a result of increasing manganese from an average of 0·70 to 1·05 and 1·02 per cent., and lowering carbon from 0·61 to 0·55 and 0·56 per cent., the breaking strength of the steel has moved up from 51·9 to 52·7 tons per sq. in., and at the same time the elongation has increased from 13·4 to 17·0 and 18·0 per cent., and the reduction

XUM

TABLE A.—COMPARISON OF AVERAGE COMPOSITIONS AND PHYSICAL TESTS OF L.N.E.R. STEEL RAILS, SHOWING THE EFFECT OF A CHANGE FROM A HIGH CARBON TO A MEDIUM MANGANESE ANALYSIS

Rails, 95 lb. and 85 lb. per yard (47·5 and 42·5 kg. per m.), bull-head section, rolled from open-hearth basic steel by the Shelton Iron, Steel, & Coal Co. Ltd.

Year of manufacture	No. of casts	Total weight of rails	Average chemical composition					Average tensile test results			
			C	Si	S	P	Mn	Breaking strength		Elongation	Reduction of area
		Tons	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	T./in.²	Kg./mm.²	Per cent.	Per cent.
*1930 ..	51	2,500	0·61	0·125	0·042	0·041	0·70	51·9	81·7	13·4	17·1
*1937 ..	12	500	0·55	0·135	0·051	0·044	1·05	52·7	83·0	17·0	28·3
†1938 ..	45	2,000	0·56	0·132	0·038	0·038	1·02	52·7	83·0	18·0	29·2

* 95 lb. section. † 85 lb. section

of area from 17·1 to 28·3 and 29·2 per cent. The British Standard Specification is satisfied with a minimum elongation of 10 per cent.

The second step towards improved quality has been one devised in the first instance as a safety precaution rather than to increase wear resistance; this is the method of controlled or retarded cooling devised by Messrs. Sandberg, the British consulting engineers, as a protection against the development in the rail-head during cooling of stresses sufficiently severe to produce shatter-cracking. In some degree such stress-formation always takes place during the normal cooling of rails on a hot-bank, but it is accentuated by any more rapid form of cooling through the critical range of temperature, as, for example, when the rails are sorbitically treated in the manner referred to later; it was partly in the interests of their sorbitic treatment, and partly because of the serious internal fissure problem in America and elsewhere, that the protective cover for the controlled cooling of rails, known as the Sandberg oven, was devised.

The stresses to which reference has been made are the direct result of the differences in the rate of cooling of the head, web, and foot of the rail, as well as of the difference in temperature between the outside and inside of the rail-head during cooling; and it is to avoid this stress-formation that the cooling of the rails is retarded. At certain works the Sandberg ovens are fixed chambers, but the latest type of oven is a moving cover of high efficiency; in either case the rails are slowly traversed by skids through the oven, entering it at about 500 deg. C. In the oven the temperature throughout the whole of the rail first becomes uniform, and the rails are then allowed to cool, at such a rate that no substantial temperature difference is set up, down to about 300 deg. C., after which they are passed out into the open air to cool down to atmospheric temperature.

The Southern Area of the L.N.E.R. was one of the first users in Great Britain to specify controlled cooling for all its rails, and Table B witnesses to the considerable influence that the combination of medium manganese composition and controlled cooling has had on the physical properties of the steel; it shows the breaking strength, elongation, and reduction of area of rail steel, before and after the change, at three different rail-mills, averaged over considerable tonnages of rails for the L.N.E.R. Southern Area, again including every cast without omission in each batch of rails. The falling weight tests alone have been omitted, as these throughout were satisfactory, and the results do not offer so instructive a basis of comparison as the tensile tests.

With the Bessemer acid rails, in which carbon was reduced by an average of 0·04 per cent. (from 0·53 to 0·49 per cent.), while manganese was raised from 0·77 to 1·13 per cent. (by 0·36 per cent.), tensile strength has been raised from 50·1 to 51·9 tons per sq. in., and at the same time the elongation has risen from 16·8 to the remarkable average figure of 20·3 per cent., and reduction of area from 24·8 to 34·8 per cent. In one of the open-hearth basic comparisons the effect is seen of maintaining the average carbon constant at 0·56 per cent., but raising the manganese from 0·80 to 1·11 per cent.; this increased the average breaking strength from 50·3 to 53·6 tons per sq. in., but at the same time the average elongation has risen from 14·8 to 18·0 per cent., and the average reduction of

TABLE B.—COMPARISONS OF AVERAGE COMPOSITIONS AND PHYSICAL TESTS OF L.N.E.R. STEEL RAILS, SHOWING THE EFFECT OF A CHANGE FROM A HIGH CARBON TO A MEDIUM MANGANESE ANALYSIS, TOGETHER WITH CONTROLLED COOLING

Rails, 95 lb. per yard (47·5 kg. per m.), bull-head section

Year of manufacture	No. of casts	Total weight of rails	Average chemical composition					Average tensile test results			
			C	Si	S	P	Mn	Breaking strength		Elongation	Reduction of area
		Tons	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	T./in.²	Kg./mm.²	Per cent.	Per cent.
Bessemer acid rails, United Steel Companies Ltd., Workington											
1920 ..	90	1,500	0·53	0·125	0·045	0·057	0·77	50·1	78·9	16·8	24·8
1937 ..	95	2,000	0·49	0·130	0·042	0·052	1·13	51·9	81·7	20·3	34·8
Open-hearth basic rails, Cargo Fleet Co. Ltd.											
1920 ..	29	1,500	0·56	0·099	0·053	0·041	0·80	50·3	79·2	14·8	19·5
1937 ..	54	2,500	0·56	0·112	0·035	0·036	1·11	53·6	84·4	18·0	29·0
Open-hearth basic rails, Lancashire Steel Corporation Ltd.											
1926 ..	32	1,500	0·61	0·131	0·040	0·034	0·73	52·3	82·4	15·4	24·4
1938 ..	71	3,500	0·56	0·164	0·035	0·031	1·12	53·4	84·1	18·5	36·2

area from 19·5 to 29·0 per cent. In the other open-hearth basic comparison, the average carbon has been reduced from 0·61 to 0·56 per cent., and the average manganese has been raised by as much as 0·39 per cent. (from 0·73 to 1·12 per cent.), and the result has been to add slightly to the breaking strength, from 52·3 to 53·4 tons per sq. in., while the elongation has gone up from 15·4 to 18·5 per cent., and the reduction of area from 24·4 to the high average of 36·2 per cent.

In Table C a further comparison is made between medium manganese rails manufactured before controlled cooling had become a standard requirement of the London & North Eastern Railway, and the present standard rail. The average compositions are similar, save that in the later rails the manganese is 0·13 per cent. higher; it will be seen that a slightly higher average breaking strength is accompanied by an increase in elongation from 16·0 to 18·5 per cent., and in reduction of area from 25·1 to 36·2 per cent. Subsequent tests that have been made at other works where at the present time medium manganese rails are being manufactured both with and without retarded cooling fully confirm the advantages in increased elongation and reduction of area that are obtained when the control of cooling is operative.

TABLE C.—COMPARISON OF AVERAGE COMPOSITIONS AND PHYSICAL TESTS OF L.N.E.R. STEEL RAILS, SHOWING THE PROPERTIES OF MEDIUM MANGANESE RAILS WITHOUT AND WITH CONTROLLED COOLING

Rails, 95 lb. per yard (47·5 kg. per m.), bull-head section, rolled from open-hearth basic steel by the Lancashire Steel Corporation Ltd.

Year of manufacture	No. of casts	Total weight of rails	Average chemical composition					Average tensile test results			
			C	Si	S	P	Mn	Breaking Strength		Elongation	Reduction of area
		Tons	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	T./in.²	Kg./mm.²	Per cent.	Per cent.
1929 ..	10	500	0·56	0·137	0·029	0·033	0·99	53·0	83·5	16·0	25·1
1938 ..	71	3,500	0·56	0·164	0·035	0·031	1·12	53·4	84·1	18·5	36·2

It may be mentioned here that in 1934 an experiment was made by the Southern Area of the London & North Eastern Railway with a still higher content of manganese, 500 tons being manufactured with an average manganese percentage of 1·52 per cent., carbon being reduced to an average of 0·49 per cent. The physical tests were slightly superior to any of those yet described, and as a matter of interest they were compared in Table D with the tests on 2,000 tons of "Plough" steel (high carbon-low manganese) rails rolled in 1929. Although the breaking strengths of the two varieties were roughly equal, the higher manganese rails showed an average elongation of 18·7 per cent. as compared with the 12·8 per cent. of the "Plough" steel rails, while the reduction of area of the former averaged no less than 38·7 per cent., or more than double the 18·2 per cent. of the latter. The higher manganese rails have given good service, but the difference in wearing capacity is not regarded as sufficient to justify a change from the standard medium manganese rail to the higher manganese quality.

On the other hand, track wear tests have proved that, as compared with the previous standard high carbon rail, the present standard medium manganese rail has an increased life of 25 to 33 per cent. To this life controlled cooling is now indirectly adding, for by the relief that it affords of harmful stresses in the rail-head, it has permitted higher combined percentages of carbon and manganese in the rails, the increased hardness so secured being combined with increased toughness, of which ample evidence is given by the elongation and reduction of area percentages just quoted. With British railways retarded cooling of all rails is now a standard requirement in the case of all the rail-mills which have installed the Sandberg oven for its application; the large majority of British rail manufacturers are now so equipped.

If the recognition of the value of manganese as a wear-resisting element in the steel be regarded as a first step towards the restoration of a work-hardening quality, and controlled cooling both as an accessory and as a safeguard in taking a longer step in that direction than might otherwise have been safely possible, the next step is that of producing, if possible, a rail sufficiently in advance of present-day traffic conditions to have some chance of work-hardening and so of prolonging its life. The possibility of doing some cold rolling on the rail-head before the rails left the works and are laid in the track, by installing some description of mill for this purpose, has been examined, but the difficulties were too great to make it practicable for the idea to be carried out, even experimentally, at any reasonable cost. A suggestion along the same lines was made in a contribution by a Russian engineer, Professor P. Sakharow, to the Proceedings of the Second International Rail Congress at Zurich in 1932, his proposal being that new rails should undergo preliminary service in secondary lines, in which the traffic is light, and thus—assuming that the rails are of suitable composition and physical properties to be capable of work-hardening—provide themselves with a protective skin on the upper

TABLE D.—COMPARISON OF AVERAGE COMPOSITIONS AND PHYSICAL TESTS OF L.N.E.R. "PLOUGH" STEEL (LOW MANGANESE-HIGH CARBON) AND HIGH MANGANESE (1·50 PER CENT.), LOW CARBON RAILS OPEN-HEARTH BASIC QUALITY

Rails, 95 lb. per yard (47·5 kg. per m.), bull-head section

Type of steel	No. of casts	Total weight of rails	Average chemical composition					Average tensile test results			
			C	Si	S	P	Mn	Breaking strength		Elongation	Reduction of area
		Tons	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	T./in.²	Kg./mm.²	Per cent.	Per cent.
Plough ..	37	2,000	0·69	0·060	0·030	0·033	0·69	55·1	86·8	12·8	18·2
Manganese..	9	500	0·49	0·164	0·027	0·034	1·52	54·5	85·8	18·7	38·7

XUM

surface before their maximum service conditions began. A considerable amount of experiment would be necessary, however, to show whether or not the increased life so obtained would be adequate compensation for the cost of the additional track-laying operations involved.

The need for a hard-wearing rail is, of course, the most acute in the case of tracks over which traffic conditions are exceptionally severe, such as lines carrying electrified suburban services, or those with heavy traffic over steep gradients and sharp curves, or switches and crossings. As in other countries, two lines of approach to this problem have been tried in Great Britain, one by the use of alloys and the other by heat treatment. The type of steel which has probably shown a greater capacity for work-hardening than any other is manganese alloy containing from 12 to 14 per cent. of manganese, but in Great Britain its extremely high cost has only justified its use in locations (chiefly complicated junction work) where the wear is altogether exceptional and traffic conditions make frequent renewals of ordinary rails a troublesome business; for this reason the use of manganese alloy rails in Great Britain does not extend, and is chiefly confined to electric lines. Another steel alloy which has been used to some extent is chromium, in percentages varying from 0·5 to 1·0 per cent., but again the use does not increase, partly because of the somewhat uncertain properties of this class of steel, arising out of the critical temperature control needed in manufacture, particularly in cooling; and partly because better wear results are now being obtained at a lower cost with heat-treated rails of standard chemical composition.

So far as concerns Great Britain, only one type of heat treatment for rails has become established, but the present indications are that this will shortly be a standard requirement of British railways for all rail renewals in locations where the life of rails is relatively short. This is the Sandberg regulated sorbitic process, for which there are now treatment plants at five different rail mills. The Southern Railway, which has the largest electrified suburban railway system in the world, and, consequently, very severe rail wear conditions, has now for some years past been laying in the track over 10,000 tons of regulated sorbitic rails annually; orders on a considerable scale have been placed this year by the London Midland & Scottish and London & North Eastern Railways as first instalments of what will in future be an annual requirement of sorbitic rails; and a future annual output of at least 20,000 to 25,000 tons of this quality for British railways alone, apart from export orders, may be regarded as probable.

The latest methods of applying the Sandberg sorbitic treatment were described in detail and illustrated in the January 10, 1936, issue of THE RAILWAY GAZETTE. The actual treatment consists in the application to the railhead, immediately after rolling, under very exact pyrometric control, of a finely atomised spray of water under pressure, special measures being taken to ensure perfectly even atomisation of the spray, and to regulate the treatment according to the chemical composition of the cast of steel concerned. The sorbitic treatment is followed by counter-cambering of the rail in a special cambering machine, to reduce to a minimum the amount of cold-straightening necessary, and then by controlled cooling.

The outstanding characteristic of the regulated sorbitic rail is the rise that takes place, in the heated area of the head, in the yield point of the steel, which proportionately is far greater than the rise in the breaking strength. Whereas the breaking strength of a tensile test cut with its centre-line $\frac{3}{8}$-in. below the running surface of the rail normally rises about 20 per cent. as a result of the treatment, the yield point may be relied on to rise by 60 per cent. or over. Compression tests that have been made upon small cylinders of steel cut from the head of sorbitically treated rails, and shaped to a diameter of $\frac{1}{2}$ in. and 1 in., have shown the same characteristics of an exceptionally high yield point when compared with similar cylinders cut from untreated rails. The depth of penetration of the treatment extends to well below the maximum depth to which the rail-head would be allowed to wear in the course of ordinary service; even at $\frac{3}{8}$-in. below the running surface, the structure of the rail is almost entirely sorbitic. In order to demonstrate the freedom of the treated steel from any shatter-cracking or brittleness as a result of the quenching treatment, the sorbitic rails are subjected to the falling weight test head downwards, so that the steel of the head is in tension, and in this position the customary 7 ft. and 20 ft. blows of a 1-ton falling weight test must be sustained without fracture of the test-piece. For information it is the general practice to give a second 20 ft. blow, which is almost invariably sustained by sorbitic rails without fracture.

Owing to the accurate control of the regulated sorbitic process, it is possible to level up steel of differing chemical compositions to one common standard of physical properties, and it is the reliability and consistency of the results obtained that have been one of the best commendations of this heat treatment to British railway engineers. In Table E there are summarised, in a form similar to the previous summaries, the results of a series of tests on various batches of sorbitic rails, for the L.N.E.R. Southern Area, and here again the whole of the tests made have been included without exception. It is now pos-

TABLE E.—AVERAGE ANALYSES AND PHYSICAL TESTS OF REGULATED SORBITIC RAILS FOR THE LONDON AND NORTH EASTERN RAILWAY, 100 LB., 95 LB., AND 85 LB. PER YARD BULL HEAD SECTIONS.
Rolled by the United Steel Companies Limited, Workington, from Bessemer acid steel.

Section of rail	No. of tests	Chemical analysis				
		Carbon	Silicon	Sulphur	Phosphorus	Manganese
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
100 lb. ..	6	0·50	0·110	0·043	0·037	1·09
95 lb. (1)	4	0·49	0·114	0·046	0·041	1·19
85 lb. ..	7	0·49	0·133	0·039	0·038	1·10
95 lb. (2)	5	0·49	0·144	0·037	0·051	1·18

Section of rail	Tensile test results					
	Yield point		Breaking strength		Elongation	Reduction of area
	T./in.²	Kg./mm.²	T./in.²	Kg./mm.²	Per cent.	Per cent.
100 lb. untreated ..	28·2	44·4	50·2	79·1	17·5	26·8
100 lb. treated	44·9	70·7	62·6	98·6	14·1	26·4
95 lb. untreated (1) ..	25·8	40·6	51·7	81·4	20·0	34·0
95 lb. treated (1) ..	44·2	69·6	63·3	99·7	14·4	30·0
85 lb. untreated ..	28·9	45·5	52·2	82·2	19·2	32·6
85 lb. treated	44·9	70·7	62·0	97·7	15·9	31·5
95 lb. untreated (2) ..	30·5	48·0	53·4	84·1	18·8	31·5
95 lb. treated (2) ..	52·7	83·0	64·6	101·7	14·5	28·4

sible to rely on obtaining a yield point not less than 40 tons per sq. in., while elongations average over 14 per cent. and reductions of area over 30 per cent. The last batch of rails showed the best average results yet; the average yield point was 52·7 tons per sq. in., the average breaking strength 64·6 tons per sq. in., the average elongation 14·5 per cent., and the average reduction of area 29·1 per cent., and all with tensile tests of 0·564 in. diameter cut with their centre-lines $\frac{5}{8}$-in. below the running surface of the rails.

In its combination of hardness with toughness, as expressed by the exceptional proportion of yield point to breaking strength, the Sandberg regulated sorbitic rail may therefore be expected to offer good resistance to abrasion, and the correspondingly high yield point in the compression tests indicates equal resistance to battering tendencies under the rolling load. These anticipations have been fulfilled in wear tests which have been made by the 200 tons of open-hearth basic rails included in this table were a batch manufactured recently by the Lancashire Steel Corporation Ltd., and the tests were notable in that while the average elongation dropped slightly from 18·4 to 16·3 per cent., the average reduction of area rose from 33·3 to 37·7 per cent.—a figure nearly 50 per cent. greater than that obtained with the chromium rails. There is last of all the fact that the sorbitic treatment adds only from 12 to 15 per cent. (according to the tonnage ordered at one time) to the initial cost of the rails, whereas the addition for a 1·0 per cent. chromium composition is 20 per cent.

As in other countries, so in Great Britain the punishment to which the steel rail is subjected in main lines becomes progressively and rapidly more severe. Some of the fastest British express trains run over the London and North Eastern Railway; whereas at the beginning of 1932 the fastest schedule on the Southern Area of the

TABLE F.—COMPARISON OF AVERAGE ANALYSES AND PHYSICAL TESTS OF L.N.E.R. CHROMIUM AND REGULATED SORBITIC RAILS, 95 LB. PER YARD, BULL-HEAD SECTION

Total Weight	No. of Tests	Average chemical composition						Average tensile test results			
		C	Si	S	P	Mn	Chr	Breaking Strength		Elongation	Reduction of area
Tons		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	T./in.²	Kg./mm.²	Per cent.	Per cent.
*1,000 ..	28	0·51	0·207	0·044	0·040	0·86	0·96	60·4	95·1	12·7	25·7
†1,000 ..	22	0·49	0·127	0·041	0·042	1·14	—	63·1	99·4	14·7	28·3
‡ 200 ..	6	0·55	0·166	0·033	0·028	1·18	—	62·5	98·5	16·3	37·7

* Chromium steel rails, open-hearth acid quality. † Regulated sorbitic steel rails, Bessemer acid quality.
‡ Regulated sorbitic steel rails, open-hearth basic quality

Southern Area of the London & North Eastern Railway, which have been sufficient to decide future policy by the decision to use sorbitically treated rails in all tracks which are to carry electric trains in future, or in tracks laid hitherto with ordinary rails which have had a shorter life than ten years, as well as extensively in switch and crossing renewals. One wear test in the open, from the most recent batch of regulated sorbitic rails, has to the present time shown a loss of weight by wear which averages per annum roughly one-half that of the last previous rails in the same location.

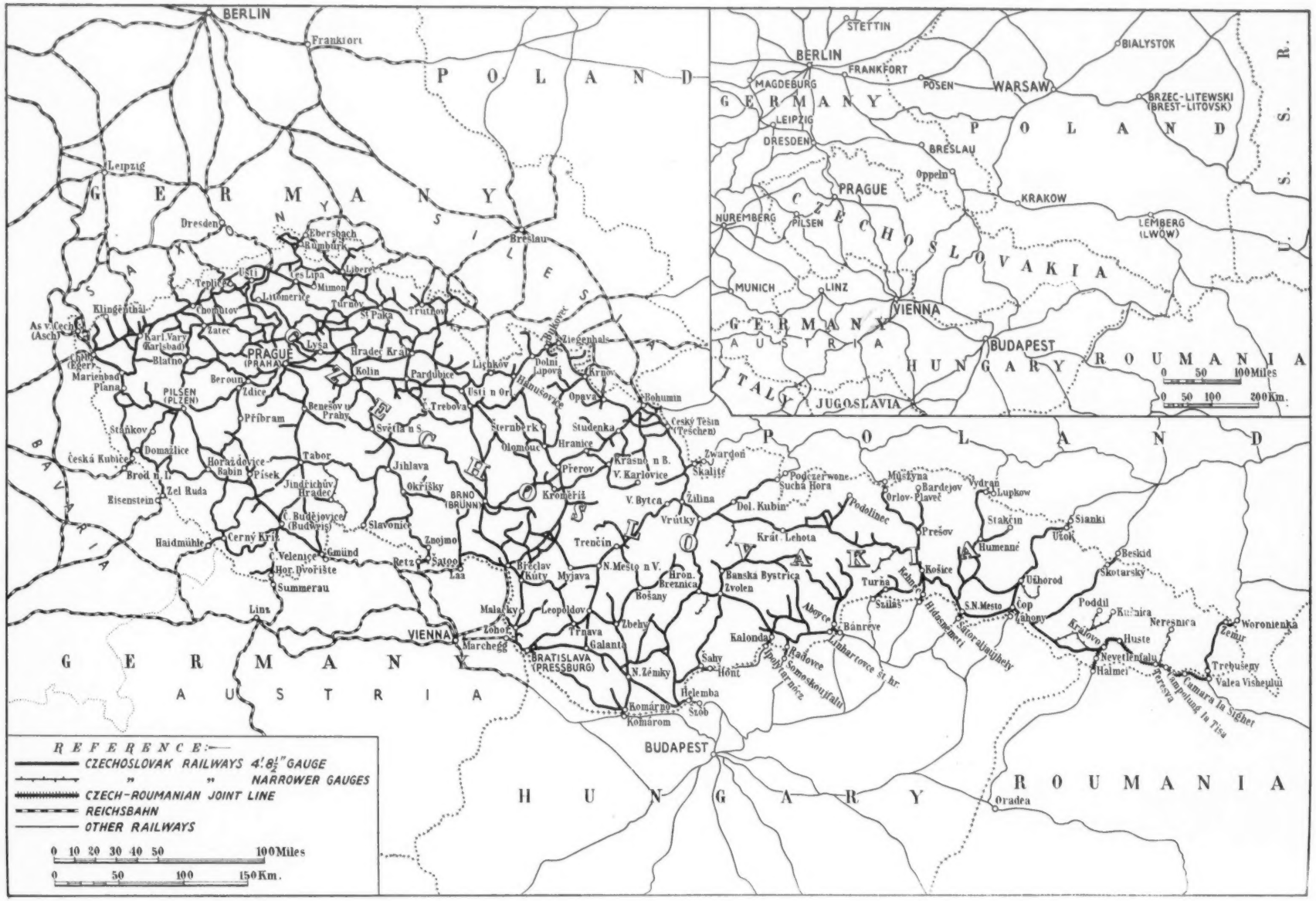
From the decision just referred to rails in tunnels are excepted, as it has been proved by experiment that the sorbitic structure offers no additional resistance where severe corrosion is a factor determining the effective life of a rail. As yet the problem of rails in tunnels in which corrosion is severe—especially tunnels in which the sulphur constituent from the exhaust of steam locomotives combines with moisture to form weak sulphuric acid—cannot be said to have reached a satisfactory solution in Great Britain. After lengthy experiments in one of the worst tunnels on the Southern Area of the London & North Eastern Railway, in which both copper and chrome have been used in varying ways for alloying the steel, in conjunction also with higher percentages of manganese, the decision has been reached that for the present the most satisfactory method of prolonging the life of the rails in at least some degree is that of painting, the precise method of which is still under consideration.

Table F, in conclusion, compares the compositions and physical properties of chromium and sorbitic rails that have been used on the L.N.E.R. Southern Area. The sorbitic tests are seen to be superior, and this superiority has been confirmed by wear tests; further, the greater consistency in the physical properties of the sorbitic rail, and its greater reliability, have to be taken into account. The L.N.E.R. was one of 57·6 m.p.h. from start to stop, by 1938 this speed has risen to the 71·9 m.p.h. of the streamlined Coronation express from London to York. Maximum speeds seldom greatly exceeded 80 m.p.h. in 1932; now 90 miles per hour is commonly reached by the principal express trains, and with the streamlined trains, despite operation by steam, 100 m.p.h. is not infrequently attained. With these much higher speeds locomotive weights are steadily mounting; a large number of the express passenger and freight locomotives of the L.N.E.R. now carry from 60 to 66 tons on their three coupled axles, and locomotives weighing from 92 to 104 tons without their tenders, and 148 to 162 tons with their tenders, are used in considerable numbers. So far from attempting to reproduce the lengthy life in the track of the early rails, therefore, the permanent way engineer of today finds it no easy task even to keep pace with the effect of these increasing stresses, let alone to outstrip them.

In endeavouring to meet these conditions, and with the valuable evidence obtained from the characteristics of the early rails whose excellent wear attracted attention in the past, the Southern Area of the L.N.E.R. has proceeded by logical stages. For general use, the high carbon rail has been changed to the medium manganese rail with controlled cooling as the standard, and without any additional cost; while for those sections of the track which carry the heaviest traffic the standard medium manganese rail is subjected to the sorbitic treatment, as a decisive step, at a moderate additional cost, in the direction of a rail which is capable in at least some measure of prolonging its life by work-hardening.

In conclusion, the author of the paper expressed indebtedness to Mr. R. J. M. Inglis, Engineer, Southern Area, London and North Eastern Railway, under whose direction this research has been carried on, for permission to publish the results.

XUM



THE RAILWAYS OF CZECHOSLOVAKIA

THE RAILWAYS OF CZECHOSLOVAKIA

Some notes on the present extent of the railway system and the methods of overcoming post-war frontier difficulties

WITHIN recent years political events have caused us to reiterate more than once that our editorial policy is to record essential transport facts throughout the world without political bias or partizanship. In any suggested readjustment of national frontiers the situation of the railways is necessarily a factor of considerable importance, and accordingly we reproduce on the opposite page a map showing the railways of Czechoslovakia, and below we publish some notes from two special correspondents on the railways of that country. —ED. *R.G.*]

The State of Czechoslovakia came into being on October 28, 1918, as an independent republic assuming responsibility for the government of some 55,000 sq. miles of territory which had hitherto belonged to the Austro-Hungarian monarchy. It comprises the former provinces of Bohemia, Moravia, part of Silesia, and Slovakia (including Ruthenia). The Allied and Associated Powers formally recognised Czechoslovakia by the treaty of St. Germain of September 10, 1919. The present population is estimated at about 15,000,000, of which some 65½ per cent. (nearly 10 million) are of Czech or Slovak race, 23½ per cent. (3½ million) of German race, 5½ per cent. Magyars, 3½ per cent. Ruthenians, ½ per cent. Poles, and the balance of other races.

According to the latest available information the railway mileage open is as follows:—

State railways under State management	11,505 km.	(7,146 miles)
Private railways under State management	2,024 ,,	(1,260 ,,)
Total of miles managed by the State	13,529 ,,	(8,406 ,,)
Private railways under company management	215 ,,	(134 ,,)
Sections of line under foreign management	74 ,,	(46 ,,)
Total of railways in Czechoslovakia	13,818 ,,	(8,586 ,,)

Of this total of mileage open, 13,396 km. (8,324 miles) is of standard gauge, and 422 km. (262 miles) of various narrower gauges.

The greater part of the Czechoslovak railway system was formerly part of the old Austro-Hungarian State Railways, of which the lines in the former Austrian provinces of Bohemia and Moravia were focussed upon Prague (Praha) and Vienna; and those in the Hungarian province of Slovakia upon Budapest. As a result, east to west communication between Bohemia and Slovakia was at first a matter of some difficulty. Since 1924 therefore the State Railways Administration has constructed about 100 miles of new main line and doubled some 125 miles of single track, mainly to improve this position.

The density of population is comparatively high, being about 270 persons to a square mile, against just over 200 in post-war Austria. In fact, it has been estimated that Czechoslovakia acquired about 80 per cent. of the whole industry of the former Austrian Empire; Czechoslovak territory is one of the richest in Europe, both as regards natural resources and natural development.

Frontier Railways

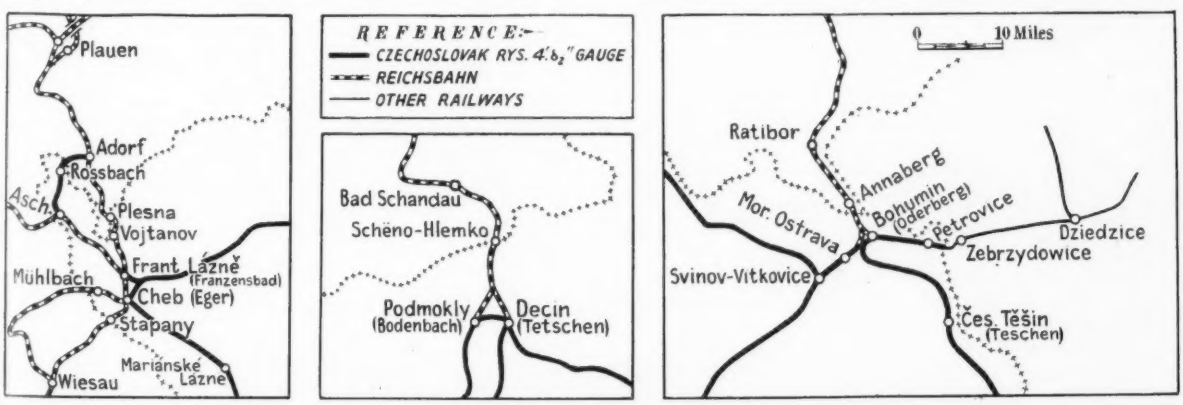
Many considerations—some adequate, others less so—helped to establish the new frontiers of Europe, and in many instances the convenience of existing railways went by the board. Many lines crossed and recrossed the new frontiers, important junctions were left on one side and the places they served on the other, currents of traffic had to be diverted to new centres of attraction and the case of Czechoslovakia was no exception to these rules. In the north, the Reichsbahn lines run into Czechoslovakia, and in the south-east there is a joint Czecho-Roumanian railway.

Reichsbahn Lines into the Country

Two main lines to Prague cross the northern frontier, one passing through Cheb (Eger) in the west, the other through Podmokly (Bodenbach) and Decin (Tetschen) in the extreme north. The main line from Berlin to Prague, *via* Dresden, splits, after entering Czechoslovakia, into two short branches so as to reach Podmokly (Bodenbach) and Decin (Tetschen), at no great distance from each other, thus finishing at two different frontier stations. These railways also are the property of the Reichsbahn. Similar splitting at the frontier occurs elsewhere, but usually on the hither side.

South-Eastern Frontier

A more remarkable instance of ownership and operation occurs along the Roumanian border where the long main West and East line runs through Královo in Czechoslovakia, Camara-La-Sighet in Roumania, and Trebušeny in Czechoslovakia again, after which it takes



Sketch maps of various Czechoslovak frontier railway arrangements

an upward turn, cutting through Czechoslovakia's rounded corner into Poland. The situation is further complicated by the fact that Valea Visheului in Roumania has to be approached from the direction of Oradea (also in Roumania) through Halmei (near the frontier) and Královo in Czechoslovakia.

It was originally arranged for Czechoslovakia to have running powers for 15 years over the Roumanian section, with the idea that during this period Czechoslovakia would have had time to build a new line on its own side of the frontier. The two countries eventually agreed, however, that instead of building duplicate lines the section from Halmei to Královo and Valea Visheului should be worked jointly by the two Governments. This provides what is believed to be the only instance of a joint State Railway.

North-Eastern Frontier

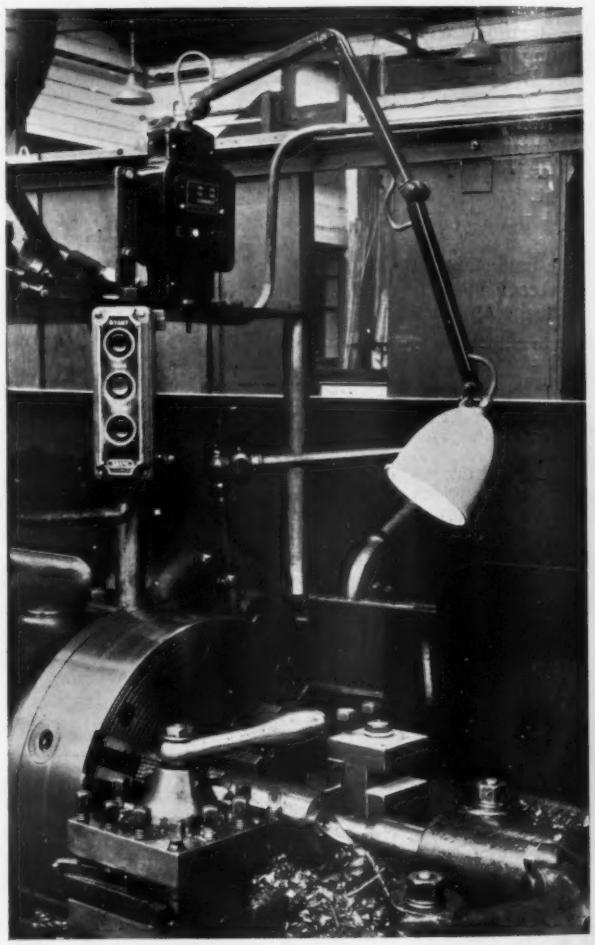
In two instances, Bohumin (Oderberg) and Ziegenhals, in Germany, the railways of one country cross the frontier to reach an important town just beyond. The chief railway connection from Ratibor, in Germany, to the important Polish Dziedzice railway centre, is *via* Bohumin, cutting the frontier twice. In this case, the Reichsbahn agains runs into Czechoslovakia, a distance of 3 miles only, and a Czechoslovak State Railways line extends it and penetrates into Poland between the stations of Petrovice and Zebrzydowice. The case of Ziegenhals is simpler. The Czechoslovak line from Mor. Ostrava to Hanusovice is nowhere far from the frontier, and to serve Ziegenhals crosses a corner of German territory, but the whole line is Czechoslovak property.

IGRANIC LOW-VOLTAGE SAFETY LIGHTING

A transformer system giving a safety supply for use where handling is unavoidable

IN modern factories the use of local lighting, whether by fixed or portable units, is as far as possible discouraged, but it is doubtful whether any scheme of general lighting will ever suffice to eliminate completely the need for such special purpose units as must still be provided here and there in every factory to facilitate work of an unusual kind. The wiring of special purpose units has always presented a certain amount of difficulty because electrical conductors and parts brought within the reach of operatives, and into situations where they are liable to meet with accidental damage, need additional protection, unless they are to be a source of unreliability or of danger. The element of danger is a very real one with hand lamps wherever they may be used, and in general the fixed or adjustable unit which can be reached by the operative gives rise to the risk of shock, more particularly where the work necessitates the use of water and where, in consequence, surroundings are apt to be sloppy. For units that are accessible, or intended to be handled, a low voltage supply is very desirable, and if the main supply is an a.c. one the provision of a local supply of not more than 50 volts can be contrived easily and at relatively small cost by means of a small transformer.

Advantage has therefore been taken by the Igranic Electric Co. Ltd. of this possibility to market the convenient little fitting illustrated herewith. This contains a transformer of 48 or 100 watts continuous capacity, protected by twin fuses on both high and low voltage sides, and a switch for bringing the unit into operation. Called the Lo-Vo-Lite it serves to insulate the illuminating unit (also supplied by the Igranic Electric Co. Ltd.) from the mains while delivering current to it at 12, 25, or 50 volts according to the particular transformer winding called for. Standard units are available for mains voltages between 110 and 550, but the transformer can be wound to suit individual requirements for a small additional charge. Input and output connections are attached to the base or box housing the unit, but the mechanism itself (switch fuses and transformer) is attached to the front or lid of the box, and removal of this lid simultaneously isolates everything from the supply, by breaking contacts, and renders it accessible for examination. The mains contacts within the box are exposed by removal of the lid but only through small slits in a substantial insulating cover. They are thus inaccessible except to the mating contact fingers of the lid mounted unit. The removable lid makes a watertight joint with the box and is secured by two nuts. As in all good transformers for giving safety from shock the two windings have an earthed metal shield between them, and also one end of the secondary winding is earthed. Safety is thus ensured even in the unlikely event of a primary winding insulation breakdown.

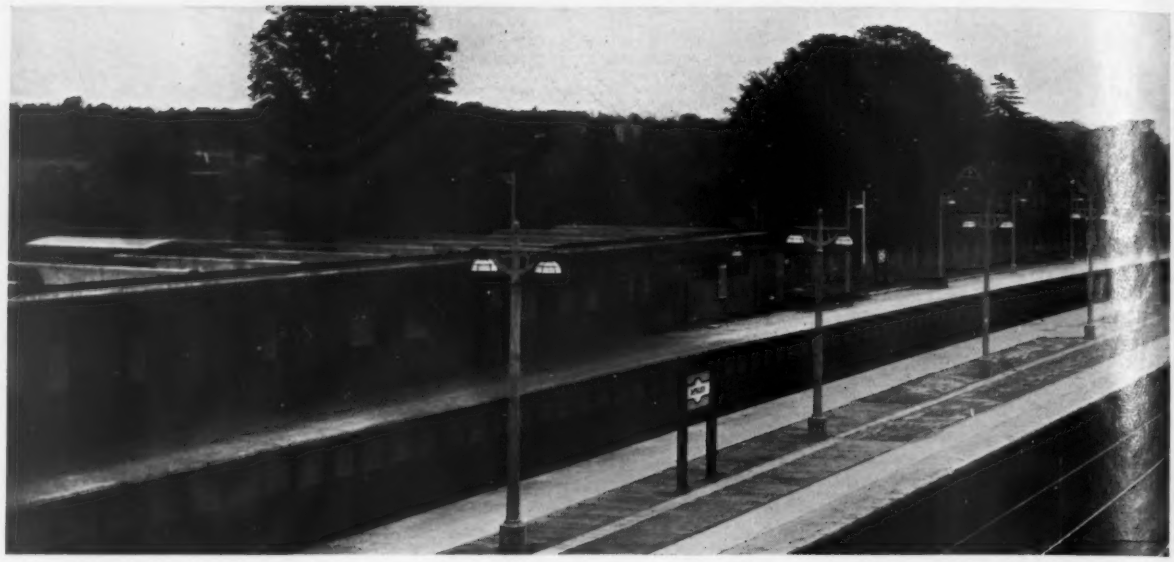


Low-voltage lighting set applied to a turret lathe. Note flexible mounting of light to shine where required

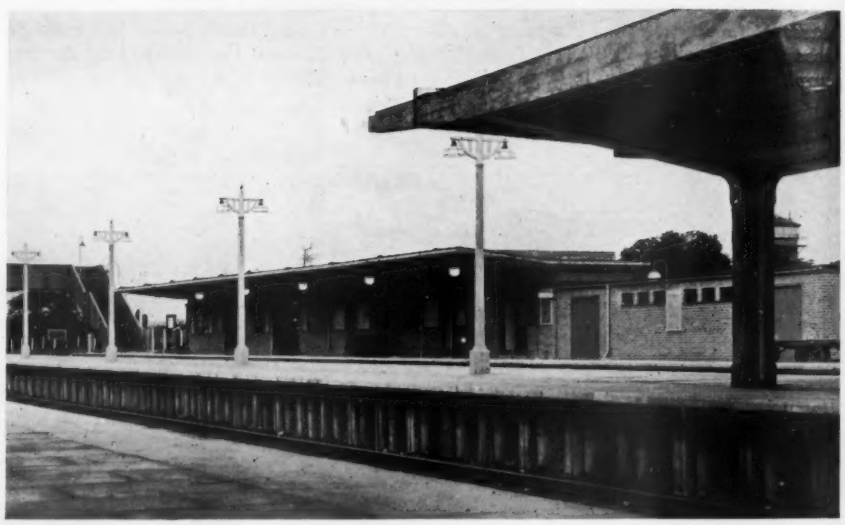
One of the eight new "C" class 4-6-0 type locomotives with 12,000-gallon tenders recently delivered by Walker Brothers Limited, of Maryborough, Queensland, to the Commonwealth Railways, for working the Trans-Australia expresses between Port Augusta and Kalgoorlie. The introduction of these engines has made possible the accelerated schedules of these trains—quoted on page 153 in our issue of July 22—and has enabled long distances to be run between suitable water supplies on the desert section. Brief details of these engines were given on page 439 in our issue of September 10, 1937

A border guard of the U.S.S.R. watching a train cross the Latvian-Soviet frontier under an archway bearing the Russian inscription "Communism will sweep away all frontiers"

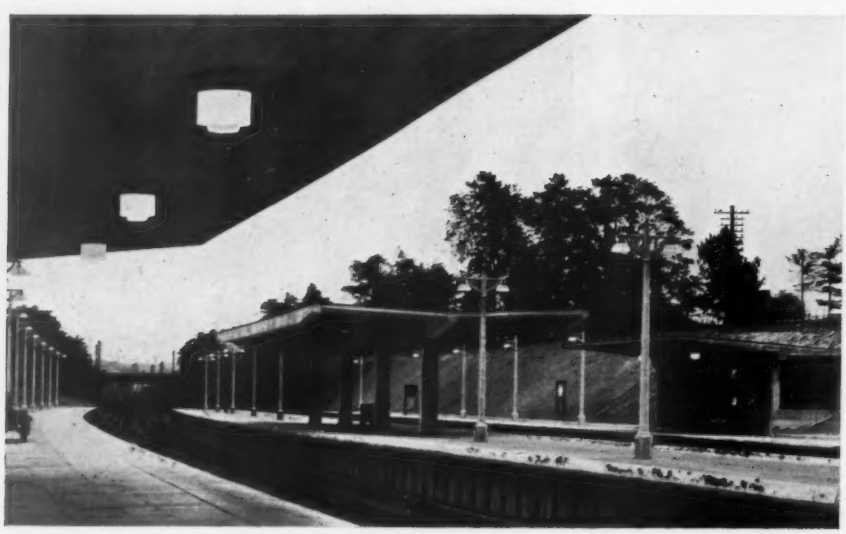
A view taken at the end of August, between Mittenwald and Innsbruck, showing a vehicle of the former Austrian Federal Railways indicating the change of ownership (see editorial note on page 549)



(Above) Apsley station from footbridge. This and the other pictures strikingly illustrate the combination of economical construction and pleasing appearance obtainable by the use of modern reinforced concrete designs



(Right) Apsley station from down fast platform Note the concrete lamp posts, platform awnings, and platform walls



(Left) Apsley station from up slow platform. The pleasant lighting arrangements and the island platform umbrella roof are noticeable

(See article on opposite page)

NEW STATION AT APSLEY, L.M.S.R.

Attractive passenger accommodation — Reinforced concrete platform awnings—Novel opening ceremony

A NEW station at Apsley, between Hemel Hempsted and King's Langley stations, was opened for public business last Monday, September 26, by the L.M.S.R. It has been built in order to cater for the large business associated with the nearby mills of John Dickinson & Co. Ltd., and for growing residential development in this part of the borough of Hemel Hempsted. The population of Hemel Hempsted has increased from 15,000 in 1934 to 18,570 at the present time, and with the opening of Apsley station, Hemel Hempsted is now served by three L.M.S.R. stations and two halts within the borough. Apsley serves a part of the borough having about 8,000 inhabitants and lying to the south of the part served by the principal L.M.S.R. station (Boxmoor & Hemel Hempsted), which is of great historic interest as having been the original temporary terminus of the first section to be opened of the London & Birmingham Railway. The present station at Boxmoor & Hemel Hempsted issues an average of 9,000 tickets a month, and 300 season tickets; it also forwards a monthly average of 4,500 parcels and 2,700 tons of merchandise, and nearly 90 per cent. of the last named item is in connection with the business of John Dickinson & Co. Ltd.

The new station has been built opposite the mills founded by John Dickinson, who was born in 1782. In 1809 he purchased Apsley mill, which had formerly been a corn mill belonging to the Abbey of St. Albans; very little of the old paper mill is now standing unaltered, but two of the old drying-lofts are still to be seen. Nash Mills, acquired by the founder of the firm in 1811, are also within the borough and these, too, are served by the new station. Since its foundation the House of Dickinson has progressively developed until at the present time some 5,000 people are employed at Apsley Mill.

The New Station

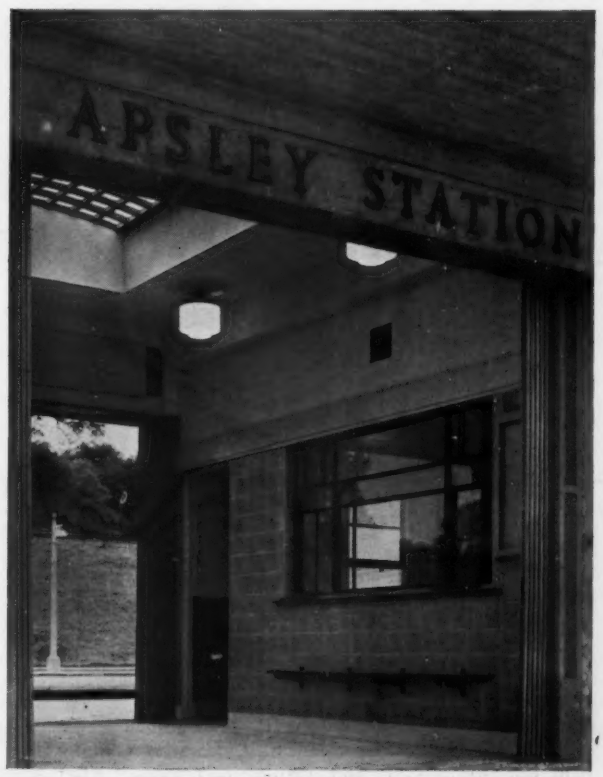
The station itself has been designed to provide the most up-to-date amenities for the travelling public, both from the practical and æsthetic aspects. It is approached from the road by a driveway lined with ornamental rock gardens tastefully laid out and leading to a spacious forecourt. The buildings, both on the road and platform side, are of reinforced concrete framing, with wide awnings for the protection of passengers. Cheerful and attractive materials and colour schemes have been embodied in the various rooms. The waiting room has a floor of green and blue tiles. The walls are lined to a height of 4 ft. in beige mottled Cellulin, whilst above this is a main frieze of cream in which are set pictorial posters executed by prominent L.M.S.R. artists. The windows are in bright scarlet, and the seating accommodation has been specially designed to harmonise.

In the entrance hall is the wide booking office window, fitted with plate glass set in an attractive bronze metal surround. The walls are lined with mottled eau-de-nil tiles; the upper part of the walls and ceiling in various shades of ivory. Bright spots of colour are introduced in the scarlet lines of the lamp fittings. A telephone booth, bookstall, and enquiry recess complete the arrangements for passengers in this part of the station.

In addition to the entrance hall and main waiting room, there is modern and attractive toilet accommodation, also a cycle store to accommodate 50 cycles. The ample parcels office is arranged in direct communication with the booking office and is equipped with up-to-date fittings to facilitate expeditious operation. In order to avoid disfigurement of the interior, the walls are lined with metal-faced plywood. Staff accommodation has been specially studied, and consists of a retiring room attractively decorated and equipped with fittings for storing equipment, &c. All the buildings are centrally heated, and the rooms are lighted by electricity from fittings of simple but artistic design. In addition to the main buildings flanking the forecourt, there is a small block of waiting rooms and lavatories on the opposite platform, designed and finished in the same pleasing way as the main group.

Externally, all the buildings with the exception of the concrete supports are faced with mulberry coloured sand-faced brick, with cream mortar joints. The windows are bright emerald green, colour notes being provided by pictorial posters set in frames planned as part of the general design. The reinforced concrete roof and awning to the main buildings are constructed with frames at 15 ft. and 12 ft. 6 in. centres, and roof slabs 4½ in. thick.

All electrical conduits were cast into the concrete as the work proceeded. The framework and awnings were erected before the general contractor began operations. The reinforced concrete work to the building on the opposite side of the station is designed without fins, presenting a perfectly level surface on top of the roof as well as to the



Entrance and booking hall, Apsley station

XUM

Inaugural train bursting paper screen

soffit and ceiling. This arrangement was carried out after experiment on the major block. The concrete roofs have been waterproofed with a layer of bitumen reinforced with fabric.

Very careful consideration had to be given to construction, particularly of the platform awnings, owing to the intensive traffic through the station, and particularly the number of high-speed trains which pass through Apsley. The platforms are formed with pre-cast reinforced concrete unit supports and platform edging, with tar macadam surfacing laid to the filling in behind the units. A feature of the station is the attractive reinforced concrete lamp standards equipped with efficient, simple, but artistic lighting. The station has been designed so that all the customary notices, posters, and other trade and commercial facilities have been incorporated in the building, resulting in an orderly appearance.

The whole of the works were carried out to the requirements of Mr. W. K. Wallace, Chief Engineer to the L.M.S.R., and the Architect was Mr. William H. Hamlyn, F.R.I.B.A. The permanent way work and general supervision was the responsibility of Mr. E. Hope, District Engineer, L.M.S.R., Watford.

The principal general contractors for the works were:—

Reinforced concrete buildings and part of roadway	Melville Dundas & Whiston Ltd., Aldine House, 10, Bedford Street, W.C.2.
Excavation, approach road, and drainage	Constable Hart & Co. Ltd., Broadway Buildings, Westminster.
General building contract ..	Kidman & Sons Ltd., Cambridge.
Steelwork for footbridge ..	The Horsehay Co. Ltd., Horsehay, Salop.

Novel Opening Ceremony

At the formal opening of the station on Thursday, September 22, a novel and spectacular ceremony was adopted. As the special train bringing guests from London ran into the new station it burst through a paper screen suspended from the platform awnings; this screen was made from paper manufactured in the nearby Apsley Mills of John Dickinson & Co. Ltd., who collaborated with the L.M.S.R. in the opening ceremony. After the arrival of the special train, Sir Reginald Bonsor, Chairman of John Dickinson & Co. Ltd., was given the first ticket (No. 000) to be issued at Apsley, and this was punched for him by Lord Stamp, Chairman of the L.M.S.R.

Luncheon was served to the guests at the Guildhouse, Apsley Mills. In proposing the toast of the London Midland & Scottish Railway Company, Sir Reginald Bonsor referred to the centenary of that company and claimed that his firm had come into existence thirty years before the railway. He also mentioned that in his earlier days his father had put him into railway work in the Claims Department of another company.

Lord Stamp, in his reply, referring to the necessity for a station at Apsley, said the guard of the special train, a Hemel Hempsted man, recalled that his grandfather, about 50 years ago, complained of having to walk to Boxmoor station and declared that there ought to be a station at Apsley. Lord Stamp also referred with much appreciation to the work of Miss A. L. Hay, in connection with the planning of the firm's gardens on the slope below the station.

Improved Exhaust Arrangements, S.R.

EXPERIMENTS by Mr. O. V. Bulleid, Chief Mechanical Engineer, Southern Railway, to improve the exhaust arrangements of the "Lord Nelson" Class 4-6-0 passenger locomotives used on the Eastern Division Continental boat expresses and on the Western Division main line, have included the fitting on engine No. 863, *Lord Rodney*, of a multiple-jet blastpipe cap, together with a large diameter chimney (1 ft. 11 in. dia. at throat, 2 ft. 4 in. dia. at top). *Lord Rodney* has recently been in service on the Victoria–Dover Continental boat expresses, and on Thursday, September 22, a test run was made on the Golden Arrow express (11 a.m. from Victoria), specially made up to a tare weight of 450 tons, to observe the performance of the engine on this arduous duty. The time between Victoria and Dover Marine was 90 min.

RAILWAY NEWS SECTION

PERSONAL

Southern Railway Chief Electrical Engineer

The directors of the Southern Railway have appointed Mr. A. Raworth (Electrical Engineer for New Works) as Chief Electrical Engineer to the company as from October 1, 1938. Hitherto, the electrical engineering work of the Southern Railway has been controlled jointly by Mr. Raworth and Mr. Herbert Jones, Mr. Raworth being responsible for all new works, and Mr. Jones for the actual operation of the electrical equipment, staffing and running of trains, &c. Mr. Jones retires today, September 30, and from October 1 the whole of the work connected with the Electrical Department of the company will be controlled by Mr. Raworth.

Netherlands Railways Management

On the retirement of Dr. H. Van Manen, Joint General Manager of the Netherlands Railways on October 1 (see our issue of July 29), the management will be put under an executive committee, consisting of a President and two vice-presidents. Dr. J. Goudriaan, now Joint General Manager, will be the new President of the Executive; and Mr. W. F. H. Van Ryckevorsel, the present Traffic Manager, and Mr. W. Hupkes, Chief Mechanical Engineer, have been appointed vice-presidents of the Executive.

Sir Edward Beatty, Chairman and President of the Canadian Pacific Railway, received on September 9 the Freedom of the City of Cranbrook, British Columbia. The honour was conferred in the course of the 40th anniversary celebrations of the opening of the Crows' Nest cut-off.

Indian Railway Staff Changes

Lt.-Colonel C. F. Carson, M.C., R.E., General Manager, N.W.R., returned from leave and resumed his duties on September 14.

Mr. E. Ingoldby, Deputy Chief Mechanical Engineer, G.I.P.R., at present employed as Director, Mechanical Engineering, Railway Board, has been confirmed as Chief Mechanical Engineer, G.I.P.R.

Mr. A. A. Phillips, V.D., has been appointed to officiate as Divisional Superintendent, N.W.R., as from July 26.

Mr. A. Raworth, whose appointment as Chief Electrical Engineer, Southern Railway, is recorded on this page, is a son of the late Mr. J. S. Raworth, and, after being educated at St. Aubyn's, Lowestoft, and Dulwich College, served an apprenticeship with Browett, Lindley & Co. Ltd., of Patricroft, Manchester, and the Brush Electrical Engineering Co. Ltd., Loughborough. From 1903 to 1912 he acted as Assistant to the late Mr. J. S. Raworth, but in March, 1912, was appointed Chief Assistant to the Electrical Engineer of the London & South Western Railway. In that capacity he was engaged to assist in the preparation of a report to the directors of the London & South Western Railway on electrification of a very large section of their suburban system, and subsequently to assist in carrying out the work. In October, 1915, Mr. Raworth joined the Royal Naval Air Service, and was commissioned as Lieutenant, R.N.V.R. In March, 1918, he was appointed Electrical Engineer to the South Eastern & Chatham Railway. In December, 1918, Mr. Raworth visited the United States to study electrification developments on behalf of the South Eastern & Chatham Railway, and in September, 1919, reported on electrification of the South Eastern & Chatham Railway suburban lines. In 1920 he gave evidence for the South Eastern & Chatham Railway before the Electrification of Railways Advisory Committee, and in the same year was appointed Chairman of the General Manager's Committee on Suburban Traffic Operation. After the amalgamation, Mr. Raworth was responsible to Sir Herbert Walker for the whole of the electrification of the Eastern Section suburban lines of the Southern Railway. From December, 1922, to June, 1925, he also acted as Engineer to the South Eastern & Chatham Construction & Power Company Limited. In July, 1925, he was appointed Electrical Engineer for New Works to the Southern Railway, and in that capacity has been responsible for the whole of the new extensions of electrification, the major schemes being London to Brighton; London to Eastbourne, Bexhill and Hastings; London to Portsmouth *via* Woking; and London to Bognor, Littlehampton, and Portsmouth *via* Horsham.

Mr. A. Raworth
Appointed Chief Electrical Engineer, Southern Railway

Mr. Herbert Jones, M.I.E.E., whose retirement from the position of Electrical Engineer, Southern Railway, is recorded on this page, was born in 1875 at Pwlmeyric House, near Chepstow, Monmouthshire, and educated at Monmouth School and at Faraday House Electrical Engineering College. After serving two years in mechanical engineering works he decided to specialise on electric traction as applied to railways. He subsequently served his time as a pupil with the City & South London Railway Company, and assisted in a great deal of the pioneer work in connection with that electric railway. He then became Technical Assistant to the late Mr. Ludwig Epstein, who at that time was carrying out some experimental work with battery vehicles for electric traction. After two years he returned to railway work as Engineer-in-Charge of the City & South London Railway Company's power house at Stockwell, and held that position for several years. When, in 1898, the Waterloo & City Railway was nearing completion, he transferred his services to that undertaking, and, in the capacity of Chief

Mr. Herbert Jones

Electrical Engineer, Southern Railway, 1923–38

Photo] *[Lafayette*

The late Sir Philip Dawson

The well-known consulting electrical engineer, and formerly Consulting Engineer to the L.B.S.C.R.

Assistant, gained further wide experience of the development of electric traction. The Waterloo & City Railway was worked by the London & South Western Railway Company from its inauguration and later was taken over. Subsequently, Mr. Herbert Jones became Electrical Engineer, L.S.W.R., and carried out various electrical work at different parts of the South Western system. He fully realised as far back as 1900 that it was only a matter of time before all the suburban lines around London and other large cities would be forced to adopt electric traction, and when, in 1912, the South Western Company decided to investigate the matter he was fully prepared. After making a study of developments in America and elsewhere he submitted a complete scheme for the electrification of the company's London suburban lines, and in December, 1912, his scheme was adopted in its entirety. Mr. Herbert Jones, with Mr. Cortez Leigh, Electrical Engineer of the L.M.S.R., was in 1925 appointed a railway representative on the board of the then newly constituted London Joint Electricity Authority, and was a member of the Railway Electrification Committee. Further reference to Mr. Herbert Jones is made on page 547.

Mr. E. H. Lennard

Appointed Dock & Traffic Manager, Port of London Authority

Mr. E. L. Stanley

Appointed Stores Officer, Port of London Authority

The late Mr. W. J. Bell

Consulting Editor of our monthly contemporary, "The Locomotive"

We regret to record the death in Berlin, on September 24, of Sir Philip Dawson, M.P., while returning from Warsaw where he had been attending the Inter-Parliamentary Business Congress. As a partner in the firm of Messrs. Kincaid, Waller, Manville and Dawson, consulting engineers, he was associated with electric power and traction developments in many parts of the world, and as Consulting Engineer to the former London Brighton & South Coast Railway was responsible for the electrification of its suburban lines. Sir Philip (then Mr.) Dawson was instructed to report on the project in 1903, and the contract for electrifying the first section—the South London line—was let in 1905, and public service on this section began in 1909. He adopted the single-phase high-tension system (6,700 volts, 25 cycles), because he had in mind the electrification of the main line to the coast, and at that period a.c. transmission for long-distance work had been developed to a higher degree than had d.c. Sir Philip was the author of numerous textbooks dealing with electric traction and power supply, and held the George Stephenson Gold Medal of the Institution of Civil Engineers and the Prince Albert Medal of the Royal Society of Arts. He was appointed by the President of the Board of Trade a member of the Water Power Resources Committee, and was created a Chevalier de l'Ordre de Leopold by King Albert for technical services rendered to Belgium during the war. Sir Philip was Vice-President of the Belgian Royal Commission appointed by the Belgian Government to investigate and report on the electrification of the Belgian State Railways, and on the unification of Belgian electric power supply. He was a member of the Disposals Board of the Ministry of Munitions from its inception, and was a member of the Electrification of Railways Advisory Committee of the Ministry of Transport. He received his knighthood in 1920. Sir Philip had been the Conservative Member for West Lewisham since 1921, and also represented West Lewisham on the London County Council, serving on the Housing, Highways, and Electricity Committees. (See also p. 547).

Mr. E. H. Lennard, who has been appointed Assistant Dock & Traffic Manager, Port of London Authority, has had 35 years' service in the Port of London. He has just vacated the post of Stores Officer, and from 1925-33 he was Investigator in the Dock and Traffic Department. He has also held posts at the docks and in the Statistical Office. During the war Mr. Lennard served in the Yeomanry and Rifle Brigade.

Mr. E. L. Stanley, who has been appointed Stores Officer to the Port of London Authority, was born in 1894 and entered the authority's service at the Surrey Commercial Docks in 1911. In 1919 he was transferred to the River Department, and in 1925 to the Staff Department. Later Mr. Stanley joined the General Manager's staff, and since 1935 he has held the position of Personal Assistant to the General Manager.

We regret to record the death of Mr. Walter John Bell, for very many years associated with our contemporary *The Locomotive*, of which he was Consulting Editor. With the engineering firm of Tait & Carlton, too, Mr. Bell had maintained a connection of exactly half-a-century, starting when he was no more than fourteen years of age. He was a founder member of the Institution of Locomotive Engineers and also of the Stephenson Locomotive Society. In authorship and collaboration he was a past master, and he was responsible not only for a number of most competent books on the locomotive and its working, but also for an extraordinary amount of research into the earlier and more obscure sections of locomotive history, the results of which were published as complete or serial articles in the pages of *The Locomotive*. He died at his home in Malden, Surrey, on September 18.

Funeral of Mr. Ernest Taylor

The sudden death on September 19 of Mr. Ernest Taylor, Chief Accountant of the L.M.S.R. until his retirement last October, was recorded in our issue of September 23. The funeral took place at St. Paul's Church, St. Albans, on September 22. A large congregation representative of Mr. Taylor's many business and personal friends attended, and included the majority of the members of the Chief Accountant's Department at Euston. In addition to the foregoing, and family mourners, the congregation included:—

L.M.S.R.: Mr. G. Royde Smith, Assistant Secretary, deputising for Lord Stamp; Mr. George Morton, Chief Accountant; Mr. O. Glynne Roberts, Secretary; Mr. F. W. Baker, Chief Cashier; Mr. E. H. d'E. Darby, Assistant Engineer; Mr. J. A. Garratt, late Assistant Accountant; Mr. Frank Watson, representing Mr. Frank Smith, Chief Rating Agent; Mr. T. E. Argile, Acting Chief Commercial Manager; Mr. F. Morton, representing Mr. D. C. K. McCulloch, Assistant Chief Commercial Manager (Goods); Mr. C. S. Howe, late Assistant to Chief Accountant; Mr. C. N. Mansfield, Assistant Chief Commercial Manager (Coal); Mr. G. L. Darbyshire, Chief Officer for Labour and Establishment; Mr. J. F. Gee, late Chief Accountant; Mr. W. H. Roberts, representing Mr. W. H. C. Clay, Estate Manager; Mr. J. H. Westwood, representing Mr. H. Rudgard, Divisional Superintendent of Operation, Derby.

Others present included: Mr. A. D. Hillings, representing Mr. Ernest Painter, Secretary, Railway Clearing House; Mr. J. Quirey, Permanent Member, Railway Rates Tribunal; Mr. G. N. Rhodes, Divisional Accountant, L.N.E.R.; Mr. R. G. Davidson, Joint Accountant, Mr. J. H. Laundey, representing Mr. A. E. Moore, Audit Accountant, Southern Railway; Mr. J. A. Kay, Editor, THE RAILWAY GAZETTE.

The following tribute to Mr. Taylor appeared in *The Times* of September 22:—

"A man of outstanding ability, his clear and powerful brain grasped at once the significant features of any complicated financial problem, and he gave his opinion in terse and cogent sentences which never left any doubt as to his meaning. He was a fine musician with an exceptionally wide and accurate knowledge of organ compositions, and had it not been for his other duties he might have won a great reputation as an organist. He was fond of many forms of sport, and in spite of his very busy life he was ever ready as opportunity offered to join in the social functions of the large staff under his control. Generous and warm-hearted, he had a firm place in the affections of his colleagues, who were always grateful for his sound and well-informed judgment, even when he was a very candid critic of their schemes."

Mr. Ashton Davies, Acting Vice-President of the L.M.S.R., presided on September 27 at a dinner given by the friends and associates of Mr. W. E. Preston to celebrate his fiftieth anniversary in the service of the L.N.W.R. and L.M.S.R. Mr. Preston joined the L.N.W.R. in the Goods Department at Berkhamsted in August, 1888, and after service in various sections of that department went to Euston in 1894. At Euston he served in various capacities in the Chief Goods Manager's Office until he was promoted to be Assistant to the General Manager, and since the reorganisation of the L.M.S.R. in 1925 he has been a specialist attached to the Executive Department of the company. In recognition of his services to the country during the great war, when he was mainly responsible for the detailed work of the Chief Goods Manager's Department of the L.N.W.R., he was included in the 1918 Birthday Honours and invested with the insignia of an officer of the Order of the British Empire. There are approximately 225,000 employees in the L.M.S.R. Company's service, and of this number only a decimal point per cent. have achieved 50 years' active service.

It is with regret that we record the death in Vancouver on September 24 of Major-General J. W. Stewart, the Canadian railway engineer. John William Stewart was born at Assynt, Sutherlandshire, in 1862, and went to Canada in 1882, where for a time he worked as a chainman on construction of the C.P.R. main line. Subsequently he became a member of the railway contracting firm of Foley, Welch & Stewart, which built the Great Northern Railway through British Columbia, the British Columbia section of the Grand Trunk Pacific, the Connaught tunnel in the Rockies, portions of the Canadian Northern Railway, and hundreds of miles of the C.P.R. system. During the great war he raised and commanded a battalion of railway troops, whose activities so impressed the British High Command that 12 additional battalions were quickly raised and placed under him. Under his direction, light railways were maintained

almost into the front line for serving the forward batteries. After the war, Major-General Stewart directed his attention to commercial construction work in various parts of the world, including the building of railways and wharves on the Gold Coast.

We regret to record the death on September 24, at the age of 81, of Lord Marks, senior partner of Messrs. Marks and Clerk, consulting engineers. George Croydon Marks was born in 1858, and, after an apprenticeship at Woolwich Arsenal, began practice as a consulting engineer in 1897. In this capacity he carried out important civil engineering works, and mechanical, hydraulic, and electrical installations. He received a knighthood in 1911, and the C.B.E. at the end of the war for services abroad on behalf of the Minister of Munitions. Lord Marks, as he became in 1929, was a Member of the Institution of Mechanical Engineers and an Associate Member of the Institution of Civil Engineers. He was the author of numerous works on hydraulic power engineering, steam generation, patents, industries, and inventions.

Mr. J. F. Aitchison was, as from August 1, appointed General Auditor of the Canadian National Railways, with headquarters at Montreal. He was born at Edinburgh, Scotland, on May 28, 1880, and joined one of the constituents of the C.N.R. in 1897 as a junior clerk at London, Ontario. He was then appointed a travelling accountant and special auditor, and was promoted to be acting Auditor of Disbursements, Montreal, in 1918; he was confirmed in this post in the following year. In 1923 Mr. Aitchison became Assistant Comptroller, and in 1930 Regional Comptroller, Toronto, the post he has just vacated to become General Auditor of the Canadian National Railways.

Mr. H. B. Emley, C.M.G., has resigned from the general managership of the Sudan Government Railways, and has been appointed General Manager of the Aire & Calder Navigation Company.

STAFF AND LABOUR MATTERS

Railway Shopmen

The Industrial Court met on September 16 to determine the claim of C. A. Deaville, employed by the London & North Eastern Railway as Grade II Fitter in the Engineering Department, York Road, King's Cross, to be re-graded as Fitter, Grade I. In support of the claim it was submitted that the work upon which the man is engaged is varied in character and includes the making up of locks of the Yale type and the alteration of safe combinations, and is work of a highly skilled character previously performed by a fully rated fitter. Apart from the skilled nature of the locksmith's work performed, it was contended that having served an apprenticeship with the company he was entitled to be graded as a Fitter, Grade I, in accordance with the provisions of Note I of Schedule " B " to Award No. 728 of the Industrial Court, which in the case of fitters read as follows:—

Fitter—Grade I. Men who have served their apprenticeship to the fitting trade or have served in the various branches of the trade for a period of five years provided that they have become fully qualified in the skilled branches.

As against the claim the company contended that the man concerned had not served an apprenticeship to the fitting trade, and was not fully qualified in the skilled branches of that trade, as apart from his employment on locksmith's work he had been entirely engaged upon the repair of weighing machines. Having regard to the nature of his duties as a locksmith it was submitted that as Award No. 728 makes no specific provision for the grading of locksmiths he was properly graded as a Fitter, Grade II, at his present rate of 46s. a week. As to his rate, reference was made to an agreement made by the Scottish railway companies and various unions, including the National Union of Railwaymen, applying the provisions of Award No. 728 to the Scottish railways in which provision was made for the rating of locksmiths (skilled) at weekly rates of 40s. to 44s. a week. Having regard to these rates it was suggested that appropriate rates for London would be from 44s. to 48s. As the rate at present paid to the man concerned falls within this range it was submitted that no change in his rate of wages was called for. The Court by Award No. 1,711 states that it is satisfied that having regard to the provisions of Note I of Schedule " B " to Award No. 728, C. A. Deaville is not entitled to be graded as a Fitter, Grade I, and it so awards. In view, however, of the nature of his duties, the Court suggests that the question of the grading and rating of Deaville should be further considered by the parties in the light of the agreement as to the rating of locksmiths (skilled) between the Scottish railway companies and certain unions to which reference is made.

Signalmen's Wages

A special delegate meeting of the National Union of Railwaymen was held in London on Friday, September 23, to consider the findings of the Railway Staff National Tribunal, contained in Decision No. 4, with regard to rates of pay and conditions of service of signalmen, relief signalmen, and traffic regulators. The conference, which consisted of eighty delegates, rejected the decision of the tribunal, only one delegate voting against the resolution for rejection. The conference instructed the executive committee that, should the companies propose to apply the tribunal's findings, the delegates should be recalled to deal with the position. A summary of the decision of the Railway Staff National Tribunal was published in our issue of August 19.

Engineering Industry—Wages

Negotiations began in London on Thursday, September 22, between the Engineering & Allied Employers National Federation and the trade unions in regard to claims submitted by the unions for higher wages and improved working conditions. There were two separate meetings and two sets of claims. The first meeting was between the employers, the Amalgamated Engineering Union, and the National Union of Foundry Workers. At the second meeting the unions represented were those forming the Engineering Joint Trades Movement—more than thirty in number. Both groups claim a substantial increase in wages—no figure being mentioned at this stage—and restoration of the working conditions prevailing before June, 1931. The Joint Trades Movement, in addition, presses for the forty-hour week. The other unions do not raise this now. The unions put their case and further meetings will be arranged after the members of the Engineering & Allied Employers' National Federation have had time to consider it.

Strike at Inchicore

This strike has been temporarily settled pending negotiations between the company and the unions. There was a further ballot held last week and the men in the shops decided, by about 4 to 1, to strike. This resulted in the works being closed, but all trains kept running, notwithstanding that coalmen, steamraisers, and even gasmen had ceased labour. It required considerable ingenuity to provide engines fully coaled for every service, but there was no hitch. On Friday night representatives of the trades unions met the Minister for Industry and Commerce, who also met Mr. Morton, the General Manager of the Great Southern Railways, and as a result of negotiations the strike proceedings were postponed until Wednesday, October 12; meanwhile representatives of the parties are to continue negotiations with a view to arriving at an agreement not later than that date. Work was to be resumed forthwith on the terms and conditions in operation before October 12. There is still an unofficial strike of the shopmen employed on road transport overhaul work at Broadstone. Considerable anxiety was felt last week, as the final of the All Ireland football match was to be held the next Sunday, which was September 25.

Census of Railway Employees

A return has been issued showing (i) the number of staff employed by the railway companies of Great Britain, the Railway Clearing House, and on the railway undertakings of the London Passenger Transport Board during the week ended March 12, 1938, and (ii) a comparison of the rates of pay and average weekly salary or wage of, and average weekly payments to, certain selected grades during the weeks ended March 12, 1938, and March 13, 1937.

Details are given of the number employed in each of the principal grades by the four amalgamated companies, certain joint committees, London Transport, and the Clearing House, with totals for each undertaking and for Great Britain. Male and female employees are shown separately, and with the exception of staff not employed directly, *e.g.*, staff employed by contractors, all persons in the service of the railway undertakings mentioned during the week of the census are taken into account. The figures represent the number of staff receiving salaries or wages for the full week combined with the equivalent number of full-time workers in cases where employees were paid for less than the complete week.

The average payments to certain of the adult male staff were shown by the returns received to be as follows:—

	Week ended— March 12, 1938	March 13, 1937
Staff entered at salaried rates:—	s. d.	s. d.
Clerical, supervisory, &c., staff (exclusive of officers and of staff entered under ancillary businesses) ...	93 10	93 0
Staff entered at wages rates (excluding staff entered under ancillary businesses):—		
Conciliation staff ...	68 7	66 1
Shop and artisan staff	71 11	70 10

The average payments represent salaries or wages, residual bonus (if any), war wage, piecework payments, tonnage bonus, payments for overtime, Sunday duty, night duty, commuted allowance and any other payments for work performed, but exclude compensation allowance, travelling and out-of-pocket expenses, and meal and lodging allowances. As from March 28, 1931, modifications were made in certain conditions of service, and the earnings of the staff were made subject to a percentage deduction. At intervals during the years 1934 to 1936 the deductions from earnings were partially restored and the standard rate for overtime (*i.e.*, time and a quarter) was re-introduced, The remaining deduction of 1¼ per cent. from earnings ceased in August, 1937, when also the standard rates for night duty and Sunday duty were restored and other concessions were given.

Summary of Total Staff Employed

Name of Company	At March 12, 1938	At March 13, 1937
G.W.R.	102,352	100,614
L.N.E.R.	177,236	175,849
L.M.S.R.	233,054	230,323
Southern	68,759	67,735
Cheshire Lines	2,811	2,791
London Transport ...	15,731	15,088
M. & G.N. Joint ...	1,353	1,358
Railway Clearing House	1,853	1,862
Other companies ...	4,129	4,032

The following table gives the numbers employed in each of the principal grades and in ancillary businesses during the selected week in 1938, with the corresponding numbers for the selected week in 1937:—

Male Staff	1938	1937
Railway Staff:—		
Capstanmen	1,147	1,163
Carters and vanguards	23,733	24,259
Carriage cleaners ...	6,677	6,504
Carriage and wagon examiners	4,252	4,240
Carriage and wagon oilers and greasers...	1,829	1,838
Checkers	8,828	8,840
Cranemen	557	528
Crossing-keepers ...	1,350	1,340
Engine cleaners ...	7,564	6,353
Engine drivers and motormen	36,977	36,202
Firemen and assistant motormen	33,474	32,842
Foremen and chargemen	7,129	7,127
Guards—goods ...	14,805	14,364
Guards—passenger ...	7,632	7,546
Hydraulic and pumping engine staff ...	760	791
Labourers	26,850	26,257
Lampmen	1,772	1,741
Loaders, callers off, ropers and sheeters	5,733	5,748
Locomotive shed staff (excluding labourers)	8,856	8,834
Messengers	979	974
Number-takers ...	1,987	1,938
Officers and clerical staff...	63,322	63,010
Permanent-way men	58,420	57,055
Pointsmen	269	292
Male Staff (contd.):—	1938	1937
Police staff:—		
Supervisory grades	152	150
Other grades ...	2,196	2,158
Porters:—		
Goods	13,519	14,318
Passenger	25,024	24,526
Porter guards ...	557	546
Porter signalmen ...	2,125	2,120
Shop and Artisan Staff:—		
Supervisory grades	2,871	2,742
Other grades (excluding labourers and watchmen)...	97,935	96,790
Shunters	17,216	16,983
Shunt-horse drivers ...	261	269
Signal and telegraph men	6,198	5,932
Signalmen	24,402	24,354
Signal box lads ...	1,562	1,579
Stationmasters, yardmasters, &c. ...	5,303	5,277
Supervisory staff (other than shop and artisan and police)	9,641	9,552
Technical staff ...	3,564	3,543
Ticket collectors ...	3,698	3,611
Traffic control staff ...	1,545	1,476
Watchmen	403	403
Miscellaneous grades	10,180	10,147
Railway total ...	553,254	546,262
Ancillary Businesses:—		
Canal staff	1,135	1,186
Dock and quay (other than shop and artisan) staff	11,499	12,119
Marine (other than shop and artisan) staff...	4,040	3,952
Marine and dock shop and artisan staff ...	3,662	3,515
Omnibus and passenger road vehicles:—		
Conciliation staff—traffic department	23	23
Hotel, refreshment room, dining car and laundry staff ...	8,277	7,982
Total—Ancillary businesses ...	28,636	28,777
Total — Male staff ...	581,890	575,039
Female Staff	1938	1937
Railway:—		
Carriage cleaners ...	706	621
Clerical and technical staff...	12,264	11,706
Crossing-keepers ...	1,529	1,530
Office cleaners and charwomen ...	2,872	2,821
Shop and artisan staff	1,095	1,100
Waiting room and lavatory attendants ...	556	538
Miscellaneous grades...	433	422
Total	19,455	18,738
Ancillary Businesses:—		
Hotel, refreshment room, dining car and laundry staff ...	5,731	5,681
Marine staff	202	194
Total—Female staff	25,388	24,613
GRAND TOTAL—ALL STAFF	607,278	599,652

York Railway Lecture and Debating Society

Mr. J. Taylor Thompson, M.C., M.Inst.C.E., Assistant Engineer, North Eastern Area, York, L.N.E.R., will speak at the opening meeting of the York Railway Lecture and Debating Society on October 4. His subject will be "Commercial Engineering," treated non-technically from the standpoints of the business side of engineering and the engineering side of business. Mr. E. M. Rutter will be in the chair.

In addition to seven meetings for lectures and debates, all to be held in the lecture hall of the Railway Institute, Queen Street, York, there will be three federation meetings at York and Darlington, to be addressed by Mr. R. Brooks of the Metropolitan-Vickers Electrical Co. Ltd.; Mr. A. T. V. Robinson, a Permanent Secretary at the Ministry of Transport; and Colonel L. Manton, Principal of the L.M.S.R. School of Transport.

Membership cards of the society cost 1s., and will be on sale at the first meeting next Tuesday, timed to begin at 6.45 p.m. in the York Railway Institute. The society also organises prize essay competitions, particulars of which will be announced in later notices to members.

THE CHICHESTER AND SELSEY RAILWAY.—In *The London Gazette* for September 23, notice is given pursuant to Section 295 (5) of the Companies Act, 1929, that the name of the Hundred of Manhood & Selsey Tramways Co. Ltd. was on that day struck off the Register, and the company thereby dissolved.

XUM

Jubilee of Frankfort Central Station

Completed in 1888, the great terminus at Frankfort-on-Main was one of the achievements of its day and is still a remarkable structure

The fine terminal station at Frankfort-on-Main, Germany, has now been in existence for half a century, and was itself opened exactly 50 years after the founding, in 1838, of the earliest railway to serve that city, the Taunus Railway. Frankfort was a highly important traffic centre before the railway era and is today a great interchange point for the international services.

The Original Four Stations

The next line to reach the city after the Taunus, which connected it with Wiesbaden, was the Main—Neckar line from Heidelberg and Darmstadt with connection to Mannheim, opened in stages by 1863; the Offenbach line was subsequently joined to it in 1875. A third station was opened in 1852 to accommodate the Main-Weser Railway, to Bad Nauheim and Cassel, with connections to Homburg and Kronberg in 1860 and 1874. The three termini, which were all close together, were known as the West stations, and there was an East station also, serving the line to Aschaffenburg, to which a connection from the western lines was later made.

By the early 'seventies, traffic had grown to such proportions that these multiple stations could no longer effectively cope with it, and, after the absorption of the Taunus line by Prussia, proposals were made for combining the working of the traffic of all four termini in a single through station. The difficulty and expense of altering the railway routes, however, led to the idea being abandoned in favour of a large central terminus. After much discussion of various designs with the different authorities interested, the final plans were accepted by the Prussian Minister of Public Works on September 8, 1879, and construction was begun almost at once. The new structure, situated about 650 yd. west of the old stations, was opened to the public on August 18, 1888, having cost 35 million Marks.

Present Station Described

The main building had a façade 230 yd. long; the centre portion containing a spacious main hall 75 ft. high with booking offices and cloak rooms, covered an area of 1,913 sq. yd. There were 18 platform lines, covered by three arced girder roof spans, 183 ft. 9 in. The station was one of the most remarkable pieces of railway architecture of its day, and is still a noteworthy building.

The average number of trains dealt with daily in the first few years was 181; by 1900 it was 358, and by 1914, 666. In that year 6 million tickets were issued, against only 1 million in 1892.

In 1905 proposals were made for increasing the accommodation, but the plans were not approved until 1911, and later the war hindered the work which was, therefore, not completed for 13 years. The number of platform lines was increased to 24 and the layout rearranged to give greater freedom of movement. Additional over-all roofs were added on each side, and the main building extended at each end by 197 ft. The main line platforms were lengthened and provided with umbrella roofing beyond the main roofing. New luggage subways, signalling, telephone and other additional equipment brought the total cost up to over 9 million Marks. Of recent years the architectural features of the station and the layout of the circulating area have been improved, and provision has been made in the forecourt for covered access to the tramways and cabs, as described in THE RAILWAY GAZETTE for March 19, 1937. A comprehensive illustrated article by Herr Carl Grospietsch in *Die Reichsbahn* describes the development of Frankfort-on-Main station.

"The A.B.C. Railway Guide"

Another stage in the development of the well-known "A.B.C." alphabetical railway guide is reached with the publication of the October issue,* which also commemorates the eighty-fifth anniversary of the establishment of this useful compendium. The principal improvement is in the important matter of legibility, for the entire book has now been reset in clear face type—in itself a vast task, seeing that the tables occupy 738 pages of the issue. Another 250 pages are occupied with a comprehensive series of hotel advertisements, 1,300 in all, covering the whole country. As compared with the previous edition, sections have been added showing the railway-associated bus and coach services and the air services from London to a large number of places, with full details of fares in each case; and another useful addition is that of notes respecting bus facilities from neighbouring cities and towns which supplement sparse railway facilities to some of the outlying places. As concerns Scotland, some ingenious tables at the end of the book give the complete train services from London to 276 Scottish stations, which are arranged in alphabetical order, with the relevant arrival times under the principal London departures at the head of each column; for simplified train-finding, this is one of the best things of its kind that we have yet seen.

We are glad to see that possible improvements to which we drew attention when last reviewing the A.B.C. have now been carried into effect; the services to one-time competitive points, which may now be regarded as impossibly roundabout and only confusing to the uninitiated traveller, have been excised; and more stations than previously have their services to and from London fully set out, instead of the somewhat unhelpful information "see trains to so-and-so, and thence about four times daily." In other cases, although times are not fully set out, the information as to connections and the travelling time to and from the nearest important station are set out in more detail than heretofore. But the ideal A.B.C. will never be reached until the passenger is shown by what trains he must leave London to reach every station appearing in the tables, and *vice versa*. If space and bulk should be a difficulty in carrying out such a plan, much might be economised by cutting down the complete lists of trains from London to outer suburban stations which have the benefit of systematic services, and electric services in particular; to take one example, the services to and from Dorking occupy two entire pages (6 columns) of the guide, owing to the very close intervals at which they run. In such a case "trains every so many minutes, at so many minutes past the hour," might meet the case, and free a great deal of space for giving the complete train services to and from minor stations. However, the "A.B.C." can be thoroughly commended for the mass of accurate information that it affords the London traveller, and it is commendable that the latest improvements have been provided without any increase in its price of two shillings.

**The A.B.C. Railway Guide*, October. London: Thomas Skinner & Co. (Publishers) Ltd., 330, Gresham House, Old Broad Street. 8½ in. × 5 in. × 1½ in. 738 pp. Paper covers. Price 2s. 0d. net.

Railway and other Reports

Trent Motor Traction Co. Ltd.—An interim dividend is being paid of 4 per cent., the same as a year ago.

E.N.V. Engineering Limited.—This company proposes to capitalise £50,000 of the reserve account shown in the last balance sheet at £75,000, and to distribute as bonus one fully-paid 5 per cent. preference share for every five ordinary shares held.

San Paulo (Brazilian) Railway Co. Ltd.—The directors have declared an interim dividend on account of the year ending December 31, 1938, of 2½ per cent. less income tax on the 5 per cent. non-cumulative preference stock, payable to holders on the register as at September 27. Warrants will be posted on October 24. The board has decided to await the completion of the accounts for the financial year to December 31, 1938, before considering the question of dividend on the ordinary stock.

NOTES AND NEWS

S.A.R. Permanent Way Programme.—The South African Railways & Harbours Board is to spend £2,500,000 this year on track renewals and improvements.

Italian Electric Train in Collision.—On September 26 a Rome-Naples electric train collided with a goods train near Formia station, about 50 miles north of Naples. Eight persons are reported to have been killed.

Croxdale Station Closed.—With the introduction of the winter timetable on Monday last, September 26, the L.N.E.R. withdrew the passenger train service from Croxdale station, situated on the main line from King's Cross to Edinburgh, 4¼ miles south of Durham.

Greenwich Time Train.—The L.N.E.R. announces that, for the convenience of Post Office and other night workers affected by the restoration of Greenwich Time, an additional train will leave Romford at 3.0 a.m. Greenwich Time, on Sunday next, October 2, calling at all stations to Liverpool Street.

Ditton Priors Light Railway.—The announcement in our editorial columns in the August 12 issue, that the Great Western Railway intended to discontinue the passenger-train service on the Cleobury Mortimer-Ditton Priors branch with the introduction of the winter timetable, has now been carried into effect. As there was no Sunday service, the last passenger train was that scheduled to leave Ditton Priors halt at 6.23 p.m., on Saturday last.

Gaelic Football Final in Dublin.—For this match, which was played on Sunday, September 25, the Great Southern Railways ran about 45 special trains, but many of these, of course, were connected with main-line trains, while on the other hand, many of the main-line trains were duplicated. The main-line trains from Tralee, Cork, Galway, and Limerick were double-headed, so as to clear the sections more speedily than if the two engines were used separately with duplicated trains. The Great Northern Railway ran about 20 trains to Dublin, including eight from Belfast. The result of the match was a draw, which some wag described as a win for the railways, who will naturally obtain somewhat similar traffic in respect of the replay.

Beyer-Garratt Locomotives for Algeria.—The Algerian State Railways has, we are officially informed, placed an order with the Société Franco-Belge de Materiel de Chemins de Fer for a further six 4-6-2 + 2-6-4 Beyer-Garratt express passenger locomotives. This is the fourth order for this type of locomotive placed by the Algerian State Railways, bringing the total number to 23. These locomotives have been designed in collaboration with Beyer, Peacock & Co. Ltd., and this further order indicates the success of the Beyer-Garratt locomotive for express work, of which the Algerian Railways has now had six years' experience. We described this type of locomotive in our issue of August 5, 1932, and further references appeared in our issues of September 29, 1933, November 9, 1934, and March 15, 1935.

German Railway Accident.—A local train entering the station of Borken in Westphalia, on September 26, collided with a light engine ; 18 passengers are reported to have been killed and a number injured.

Argentine Railway Earnings.—The gross receipts of the privately-owned Argentine railways for the eleven months of the financial year 1937-38 (from July, 1937, to May, 1938) amounted to 423,230,000 pesos m/n., a decrease of 51,724,000 pesos or 12·2 per cent. compared with the corresponding period of the previous financial year. The receipts of the British-owned lines, included in the foregoing figures, were 380,423,000 pesos m/n., or 41,771,000 less (11·0 per cent.). The decrease was mainly in goods traffic, which was 17·6 per cent. less, while passenger receipts were 3·6 per cent. higher. The Cordoba Central figures are not included since this undertaking is considered now as a State railway.

Head-on Collision near Barcelona.—A collision occurred between Martorell and Castellbisbal, 20 miles west of Barcelona, on the night of September 25, when two crowded passenger trains met head-on in a blinding rainstorm. One of the trains, from the Villafranca direction, was proceeding at high speed towards Barcelona on the single line, and crashed into a train which had just left Martorell. Sixty-eight persons are reported to have been killed and 300 injured. The station employees attribute the accident to interference with signals caused by the heavy rain and electrical disturbance, but another version is that the station staff at Martorell gave line clear to the slow train, with the other train already in the section. Owing to the present restricted service, both trains were heavily loaded with passengers. An official enquiry was at once opened into the causes of the accident.

L.M.S.R. Station Changes.—With the introduction of the winter timetable on the L.M.S.R. on Monday last, September 26, two new stations were brought into service—Apsley, between King's Langley and Boxmoor, Herts (the ceremonial opening of which we recorded last week), and Bowker Vale, between Heaton Park and Crumpsall on the Manchester-Bury electric line. Owing to lack of traffic, Cornholme station (between Todmorden and Portsmouth, Lancs), and Robins Lane halt (between St. Helens Junction and Sutton Oak) were entirely closed, and as there is now no train service on the Welsh Highland Railway, Dinas Junction, Caernarvonshire, which was the exchange-point between this system and the L.M.S.R., has been renamed Dinas. Declining traffic has decided the withdrawal of the passenger service from the branch line between Southport (Chapel Street) and Downholland. The passenger halts at Butts Lane, Heathey Lane, New Cut Lane, and Plex Moss Lane have been closed entirely, but Kew Gardens, Shirdley Hill, Halsall, and Downholland stations remain open for parcels and miscellaneous traffic. The Liverpool-Southport Ribble bus route passes through or is immediately adjacent to the places served by this branch. During the winter, the branch line from Ulverston to Lake Side is closed for passenger traffic, but parcels and miscellaneous traffic will continue to be handled at the stations concerned. (Greenodd, Haverthwaite, Newby Bridge, and Lake Side.) Alternative passenger service is available on weekdays by Ribble buses.

Cordoba Central Railway Co. Ltd.—The directors are not yet in a position to submit a scheme of arrangement to the holders of the company's first debenture stock and the two other classes of stock, as, although the Chamber of Deputies has sanctioned the Bill authorising the Argentine Government to conclude the purchase of the company's railway in the terms of the *ad referendum* agreement, it has not yet been dealt with by the Senate. The board has therefore decided, with the concurrence of the trustees and the debenture stockholders' committee, to make a payment on October 19 of 1¾ per cent., less income tax, on the first debenture stock generally on account of interest on that stock, and to postpone until January 1, 1939, or until such later date or dates as may with the like concurrence hereafter be determined, payment of the balance of the half-yearly instalments of interest which fell due on or between October 1, 1934, and April 1, 1938, as well as the further half-year's instalment falling due on October 1, 1938.

L.N.E.R. Sunday Trains to East London.—On Sundays until further notice Coborn Road station will be closed and Bethnal Green station will be served only by trains running to and from Enfield, Chingford, Hertford, Buntingford, and Cambridge *via* Bethnal Green and Hackney Downs. These alterations are necessary on account of the reconstruction of the railway bridge over Globe Road in connection with the East London electrification scheme. Passengers to and from or *via* Bethnal Green will be allowed to use the above-mentioned trains by travelling *via* Liverpool Street. Every Sunday the Ongar, Epping, Loughton, Woodford, Leyton, and Liverpool Street through train service will be suspended and ran only to and from Stratford, with the exception of the 10.51 p.m. from Epping to Liverpool Street and the 11.45 p.m. Liverpool Street to Loughton which will run through as usual omitting Coborn Road and Bethnal Green. Connection between Stratford and Liverpool Street in each direction will be available.

XUM

Closure of Charing Cross Tube Lines

On Tuesday the London Passenger Transport Board announced that urgent structural works required the Bakerloo and Northern Lines at Charing Cross to be closed from 8 o'clock that night until further notice. The District Line station at Charing Cross is open as usual. The Bakerloo Line is running from Watford and Queens Park to Piccadilly Circus only; the Northern Line from Edgware and Highgate is running to Strand station only; the Northern Line from Morden to Edgware and Highgate by way of the City and Camden Town continues to run.

The effect of these alterations is that there are no tube services between: Piccadilly Circus and Elephant & Castle on the Bakerloo Line; Strand and Kennington on the Northern Line. The following stations are closed: Trafalgar Square, Charing Cross, Waterloo, Lambeth North, Elephant & Castle, on the Bakerloo Line; and Charing Cross, Waterloo, Kennington (Charing Cross side), on the Northern Line.

The board appeals to passengers to co-operate in the unusual circumstances. There are officials at all points who are glad to give advice on the best way to travel. All tickets available over sections of the railways temporarily closed are available by any alternative route on London Transport railways, buses, or trams. There are: A special bus service between Elephant & Castle and Piccadilly by way of Waterloo station (York Road), Westminster Bridge, Whitehall, Cockspur Street; an auxiliary bus service between London Bridge and Moorgate; and a special tram service between Elephant & Castle (St. George's Road) and Blackfriars, by way of Westminster Bridge and Charing Cross.

British and Irish Traffic Returns

GREAT BRITAIN	Totals for 38th Week			Totals to Date		
	1938	1937	Inc. or Dec.	1938	1937	Inc. or Dec.
L.M.S.R. (6,834½ mls.)	£	£	£	£	£	£
Passenger-train traffic...	548,000	537,000	+ 11,000	20,431,000	20,397,000	+ 34,000
Merchandise, &c. ...	440,000	521,000	− 81,000	17,025,000	18,583,000	−1,558,000
Coal and coke ...	248,000	262,000	− 14,000	9,361,000	9,605,000	− 244,000
Goods-train traffic ...	688,000	783,000	− 95,000	26,386,000	28,188,000	−1,802,000
Total receipts	1,236,000	1,320,000	− 84,000	46,817,000	48,585,000	−1,768,000
L.N.E.R. (6,315 mls.)						
Passenger-train traffic...	346,000	344,000	+ 2,000	13,219,000	13,315,000	− 96,000
Merchandise, &c. ...	320,000	355,000	− 35,000	11,880,000	12,778,000	− 898,000
Coal and coke ...	239,000	253,000	− 14,000	8,836,000	9,299,000	− 463,000
Goods-train traffic ...	559,000	608,000	− 49,000	20,716,000	22,077,000	−1,361,000
Total receipts	905,000	952,000	− 47,000	33,935,000	35,392,000	−1,457,000
G.W.R. (3,737 mls.)						
Passenger-train traffic...	223,000	223,000	—	8,588,000	8,670,000	− 82,000
Merchandise, &c. ...	189,000	208,000	− 19,000	6,977,000	7,531,000	− 554,000
Coal and coke ...	105,000	107,000	− 2,000	4,032,000	4,215,000	− 183,000
Goods-train traffic ...	294,000	315,000	− 21,000	11,009,000	11,746,000	− 737,000
Total receipts	517,000	538,000	− 21,000	19,597,000	20,416,000	− 819,000
S.R. (2,148 mls.)						
Passenger-train traffic...	329,000	325,000	+ 4,000	12,815,000	12,884,000	− 69,000
Merchandise, &c. ...	63,500	69,000	− 5,500	2,287,500	2,389,500	− 102,000
Coal and coke ...	30,500	31,000	− 500	1,130,500	1,150,500	− 20,000
Goods-train traffic ...	94,000	100,000	− 6,000	3,418,000	3,540,000	− 122,000
Total receipts	423,000	425,000	− 2,000	16,233,000	16,424,000	− 191,000
Liverpool Overhead ... (6½ mls.)	1,316	1,286	+ 30	52,356	49,713	+ 2,643
Mersey (4½ mls.) ...	4,442	4,306	+ 136	166,100	159,035	+ 7,065
*London Passenger Transport Board ...	576,500	568,500	+ 8,000	7,286,200	7,238,500	+ 47,700
IRELAND						
Belfast & C.D. pass. (80 mls.)	2,357	2,369	− 12	100,845	104,437	− 3,592
,, ,, goods	508	404	+ 104	16,449	18,481	− 2,032
,, ,, total	2,865	2,773	+ 92	117,294	122,918	− 5,624
Great Northern pass. (543 mls.)	11,450	11,450	—	432,200	436,600	− 4,400
,, ,, goods	9,900	9,900	—	335,850	359,400	− 23,550
,, ,, total	21,350	21,350	—	768,050	796,000	− 27,950
Great Southern pass. (2,076 mls.)	36,990	37,530	− 540	1,436,835	1,438,252	− 1,417
,, ,, goods	44,672	41,581	+ 3,091	1,485,194	1,536,079	− 50,885
,, ,, total	81,662	79,111	+ 2,551	2,922,039	2,974,331	− 52,302

* 13th week (before pooling)

British and Irish Railway Stocks and Shares

Stocks	Highest 1937	Lowest 1937	Prices Sept. 28. 1938	Prices Rise/Fall
G.W.R.				
Cons. Ord. ...	67⅝	55¾	34	—
5% Con. Prefce. ...	127	108	85½	−3½
5% Red.Pref.(1950)	113	109	92½	−7
4% Deb.	113⅝	102½	99½	−4
4½% Deb.... ...	118	106	102½	−5
4½% Deb.	124½	112	108½	−3
5% Deb.	136½	122¾	120½	−4
2½% Deb.... ...	76	64	66½	—
5% Rt. Charge ...	133 16	118	115	−3
5% Cons. Guar. ...	133¾	116½	105½	−3
L.M.S.R.				
Ord.	36⅛	25⅜	12¼	−¾
4% Prefce. (1923)	82½	65¾	25½	−2
4% Prefce. ...	92½	77¾	50	−11½
5% Red.Pref.(1955)	107¾	102	72½	—
4% Deb.	108	99¼	89½	−7
5% Red.Deb.(1952)	117½	111	108½	−3
4% Guar. ...	104	95⅞	82½	−6
L.N.E.R.				
5% Pref. Ord. ...	12½	6¾	3¾	−¼
Def. Ord.	6¼	3⅝	2½	−⅛
4% First Prefce.	79½	63	23½	−2
4% Second Prefce.	31½	21	9½	−1
5% Red.Pref.(1955)	101¼	89¾	44½	—
4% First Guar. ...	103	91⅞	75	−3½
4% Second Guar.	97⅝	85½	52½	−5
3% Deb.	84⅛	74	62½	−6
4% Deb.	107¼	98½	80	−10½
5% Red.Deb.(1947)	113½	106½	100*	−5
4½% Sinking Fund Red. Deb.	110 16	105½	100	−6
SOUTHERN				
Pref. Ord.... ...	98⅝	83½	49½	−1
Def. Ord.	27⅞	16¾	10	−1¾
5% Pref.	126 16	105 15 16	85½	−3½
5% Red.Pref.(1964)	118	110¼	97½	−3
5% Guar. Prefce.	133¾	116¾	107	−5½
5% Red.Guar.Pref. (1957)	118½	111½	107	−4½
4% Deb.	112	101¼	97½	−6
5% Deb.	135¾	123½	120½	−3
4% Red. Deb. 1962–67	113	105	102½	−4
BELFAST & C.D.				
Ord.	5	4	4	—
FORTH BRIDGE				
4% Deb.	106	99½	100½	—
4% Guar. ...	105¾	99	99½	—
G. NORTHERN (IRELAND)				
Ord.	11	5	2⅞	+⅛
G. SOUTHERN (IRELAND)				
Ord.	50	21½	20	—
Prefce.	61	34	13¼	—
Guar.	94¾	69½	35	—
Deb.	95	82⅛	58	—
L.P.T.B.				
4½% "A" ...	123¾	110½	111	−2½
5% "A" ...	135	121½	119½	−3
4½% "T.F.A." ...	108¾	104	100½	−4½
5% "B" ...	125	114½	109½	−8
"C"	99¾	75	70½	−5
MERSEY				
Ord.	42⅝	22	20	—
4% Perp. Deb. ...	103	96¾	99	—
3% Perp. Deb. ...	77⅝	74½	73½	—
3% Perp. Prefce.	68¾	61¼	62½	—

* ex dividend

OFFICIAL NOTICES

CARRIAGE AND WAGON DESIGNER DRAUGHTSMAN required by large rolling stock works in India. A single man about 30 years of age preferred who has had extensive drawing office and practical works experience in a rolling stock works of repute. Five years' agreement, free passages, provident fund and a salary of about £45 per month. Apply by letter with copies of testimonials, stating age and whether married to: "SOLEBAR," c/o WM. ABBOTT, LTD., 32, Eastcheap, London, E.C.3.

The Institute of Transport Examinations, 1939

NOTICE IS HEREBY GIVEN that the Graduateship and Associate Membership Examinations will be held in London and at other centres on Thursday, Friday and Saturday, April 27th, 28th and 29th, 1939.

The latest date for the deposit of forms of entry is March 1st, 1939 (January 1st if any exemptions are claimed). Full particulars, previous question papers (price 1s. per set, post free) and copies of a revised and enlarged edition of the booklet "The Institute of Transport Examinations: notes for the guidance of candidates unable to attend preparatory courses" (price 2s. 6d. post free) may be obtained from the undersigned.

By Order of the Council,
A. WINTER GRAY,
Secretary.

15, Savoy Street,
London, W.C.2.

Indian State Railways

APPLICATIONS are invited from British subjects of non-Asiatic domicile for two appointments in the Mechanical Engineering and Transportation (Power) Department of Indian State Railways.

Candidates should be not more than 30 years of age on the 1st October, 1938, and must have passed the qualifying examination for A.M.I.C.E. or A.M.I.Mech.E., or have obtained an engineering degree or diploma giving exemption from such examination. They must have served at least four years as pupils or apprentices in locomotive workshops of a British railway, or in workshops of locomotive builders of repute, together with some training in running sheds and in firing, and one year's drawing office experience. They should have a thorough understanding of applied mechanics and the nature and composition of all materials used in shops and be able to design and to calculate stresses on parts of machines.

Further particulars and Forms of Application may be obtained, on request by postcard, from the High Commissioner for India, General Department, India House, Aldwych, London, W.C.2. Last date for receipt of completed applications 14th October, 1938.

Indian State Railways

APPLICATIONS are invited for an appointment in the Transportation (Traffic) and Commercial Departments of Indian State Railways.

Candidates must be British subjects of non-Asiatic domicile and must have been not less than 21 nor more than 25 years of age on the 1st August, 1938. They must either (*a*) have obtained a degree or other qualification as prescribed in the regulations or (*b*) have had not less than two years' practical training, as pupil or apprentice, in the Traffic Department of a British or Colonial Railway, following a sound general education.

Further particulars and Forms of Application may be obtained, on application by postcard, quoting Appointment 1/28 from the High Commissioner for India, General Department, India House, Aldwych, London, W.C.2. Last date for receipt of completed applications 14th October, 1938.

OFFICIAL ADVERTISEMENTS

OFFICIAL ADVERTISEMENTS intended for insertion on this page should be sent in as early in the week as possible. The latest time for receiving official advertisements for this page for the current week's issue is noon on Thursday. All advertisements should be addressed to:—*The Railway Gazette*, 33, Tothill Street, Westminster, London, S.W.1.

CONTRACTS AND TENDERS

Locomotives for New Zealand

The North British Locomotive Co. Ltd. has received an order from the New Zealand Government Railways Administration for thirty locomotives, chiefly for use on branch lines. The value of the order, with freight to the Dominion, is, we understand, in the vicinity of £400,000. This order is additional to those we announced last week.

The Administration of the Egyptian State Railways has placed an order with a Cardiff firm for 600,000 tons of coal.

Howell & Co. Ltd. has received an order from the Cordoba Central Railway for 1,870 galvanised solid-drawn steel boiler tubes.

Owen & Dyson Limited has received an order from the Buenos Ayres Western Railway for 250 solid-forged steel wheels for carriages and wagons.

E. & H. Ashworth Limited has received an order from the Peruvian Corporation Limited for one heavy-duty 50,000 kg. capacity railway weighbridge.

W. Alexander & Sons Ltd. has placed an order with Leyland Motors Limited for 20 oil-engined passenger vehicles.

The South African Railways & Harbours Administration has placed an order with Leyland Motors Limited for 41 special six-wheeled Hippo heavy goods lorries. Six-cylinder petrol engines developing 145 b.h.p. have been specified. During the past two years the administration has ordered more than 100 Leyland vehicles.

The Brush Electrical Engineering Co. Ltd. has received an order from the Birmingham & Midland Motor Omnibus Co. Ltd. for 50 double-deck front-entrance 56-seater omnibus bodies. The bodies will be mounted on S.O.S. six-cylindered diesel-engined chassis, designed and built by the bus company.

Beyer-Garratt Locomotives for Algeria

The Société Franco-Belge de Materiel de Chemins de Fer has received a further order from the Algerian State Railways for the supply of six 4-6-2 + 2-6-4 Beyer-Garratt express passenger locomotives. These locomotives have been designed in collaboration with Beyer, Peacock & Co. Ltd. Further particulars appear on page 575.

The Associated Equipment Co. Ltd. has received an order from the Halifax Corporation for the supply of 36 Regent double deck buses. This is the twenty-second repeat order the firm has received from this municipality, and brings the total of A.E.C. vehicles ordered during the last nine years to 199.

The Associated Equipment Co. Ltd. has also received an order from the Rhondda Transport Co. Ltd. for eight Regal single deck buses.

South African Railway Tenders

The South African Railways & Harbours Administration is calling for tenders for the following material: Vacuum and steam pressure gauges (October 3); pump trolleys, wheels and axles, bridgework, flat steel (October 4); locomotive boilers (October 10); superheater elements, locomotive boilers (October 24); structural steelwork (October 25); boiler and superheater flue tubes, (October 31); coal and manganese ore handling appliances, mild steel plates, bridgework (November 7); chain (November 10); steel bogie wagons (November 21). Copies of the specifications and other information may be borrowed from the Department of Overseas Trade.

The Victorian Railways Commissioners are calling for tenders, receivable by October 12, for the supply of the following equipment: Vertical drilling machine, universal milling machine, mortising machine and equipment, vertical wood-boring machine.

Tenders are invited by the Madras & Southern Mahratta Railway Administration, receivable by October 4, for the supply of 25,000 tie bars for pot sleepers, broad gauge. Forms of tender can be obtained from the company's offices, 123, Victoria Street, London, S.W.1.

Forthcoming Events

Oct. 4 (*Tues.*).—Institution of Automobile Engineers, at Royal Society of Arts, John Street, London, W.C.2, 7.45 p.m. Presidential Address by Mr. P. Kidner.

L.N.E.R. (York) Lecture and Debating Society, at Railway Inst., Queen Street, 6.45 p.m. "Commercial Engineering," by Mr. J. Taylor Thompson.

Mary Ward Settlement, Tavistock Place, London, W.C.1, 8 p.m. "The Planning of London: Roads," by Lt.-Col. M. O'Gorman.

Permanent Way Institution (Guildford), at Orphanage Hall, Guildford Park Road, 6.45 p.m. "Permanent Way Institution Convention in Germany, 1938," by Mr. W. A. Willox.

Oct. 6 (*Thurs.*).—The Railway Club, at Royal Scottish Corporation Hall, Fetter Lane, E.C.4, 7.30 p.m. "The London & Birmingham Railway," by Mr. H. W. Bardsley.

Oct. 8 (*Sat.*).—Stephenson Locomotive Society (Midlands-Northern), at 4, Bury Old Road, Manchester, 6.30 p.m. Annual Meeting.

Oct. 10 (*Mon.*).—Institute of Transport, at Inst. of Electrical Engineers, Savoy Place, W.C.2, 5.30 p.m. Presidential Address by Mr. Gilbert S. Szlumper, C.B.E.

Stephenson Locomotive Society (London), at King's Cross Station, L.N.E.R., 6.30 p.m. "Step Children of the Locomotive World," by Mr. J. Kite.

XUM

Railway Share Market

The grave international situation has resulted in nominal markets in all sections of the Stock Exchange. As selling pressure was heavier this week, and exceptionally small demand was experienced, quotations have been marked down heavily and the margin between buying and selling prices was much wider than is usually the case. The position was eased to some extent by the decision of jobbers to quote minimum prices for all securities in the gilt-edged market, including corporation and public board loans. This has reduced selling of Government stocks and may do much to prevent a decision to close the Stock Exchange even should war conditions develop. Securities of the home railways reflected the surrounding trend of markets and were lowered sharply, while quotations were kept very wide, particularly in the case of debentures and guaranteed issues. Owing to the inactive conditions ruling on the Stock Exchange, business in many of the stocks has been largely a matter of negotiation. L.N.E.R. 3 per cent. debentures have been lowered to 62½ at the time of writing, while the 4 per cent. debentures are 79½. Great Western 4 per cent. debentures are quoted at 99½, and Southern 4 per cents. at a similar figure. L.M.S.R. 4 per cent. debentures were 87½. Among the guaranteed stocks L.M.S.R. 4 per cents. have been marked down to 82½, L.N.E.R. 4 per cent. first guaranteed have declined to 73 and the 4 per cent. second guaranteed to 53.

Southern and Great Western 5 per cent. preference stocks have each fallen to 85, but, as in other cases, the heavy declines in price are, of course, a reflection of the general tendency of markets which has resulted from a disposition to await the outcome of this critical week in international affairs. L.M.S.R. 1923 preference reacted to 24 and the 4 per cent. first preference to 49½. Some of the preference stocks were reported to be a slightly better market following publication of the traffic figures, but they were unable to move against the surrounding market trend. It is being pointed out that if only 3½ per cent. were paid on L.M.S.R. 4 per cent. first preference, the yield on this basis would be fully 7 per cent. at the current price. Great Western ordinary was inclined to fluctuate sharply, but has declined to 33½, while Southern preferred and deferred stocks are 49½ and 9¾ respectively at the time of writing. London Transport "C" has moved down to 70½ owing to the fear that, as a result of the international political situation, the directors may decide against drawing on reserves in order to pay a dividend of 5½ per cent. on this stock. There was a general marking down of prices in the Argentine railway market and quotations were nominal in the absence of demand. B.A. Great Southern preference stocks were particularly weak, the 5 per cents. having fallen to 48 and the 6 per cents. to 27. Cordoba Central debentures found a few buyers, but the first debentures are lower at 45, as are the second debentures at 9½. American railroad stocks have fluctuated sharply from day-to-day. Canadian Pacific common and preference were lower on balance at 5½ and 28 respectively. French railway sterling bonds moved sharply against holders. Nitrate rails were on offer.

Traffic Table of Overseas and Foreign Railways Publishing Weekly Returns

	Railways	Miles open 1937-38	Week Ending	Traffics for Week: Total this year	Traffics for Week: Inc. or Dec. compared with 1937	No. of Weeks	Aggregate Traffics to Date: Totals: This Year	Aggregate Traffics to Date: Totals: Last Year	Aggregate Traffics to Date: Increase or Decrease	Shares or Stock	Prices: Highest 1937	Prices: Lowest 1937	Prices: Sept. 28, 1938	Yield (See Note)
				£	£		£	£	£					
South & Central America	Antofagasta (Chili) & Bolivia	834	25.9.38	11,400	— 2,930	39	575,460	639,750	— 64,290	Ord. Stk.	29	10¼	10½	Nil
	Argentine North Eastern	753	24.9.38	10,732	— 211	13	140,267	134,797	+ 5,470	„	19¼	6	4½	Nil
	Argentine Transandine	—	—	—	—	—	—	—	—	A. Deb.	93½	60	80	5
	Bolivar	174	Aug., 1938	3,900	900	35	30,150	45,600	— 15,450	6 p.c. Deb. Bonds.	9½	5	8½	Nil
	Brazil	—	—	—	—	—	—	—	—	Ord. Stk.	17	9	6	8516
	Buenos Ayres & Pacific	2,806	24.9.38	71,154	— 7,692	13	888,092	1,004,219	— 116,127	Ord. Stk.	17⅛	5½	5	Nil
	Buenos Ayres Central	190	10.9.38	$113,700	— $24,200	11	$1,244,900	$1,589,500	— $344,600	Mt. Deb.	41½	18	13	Nil
	Buenos Ayres Gt. Southern	5,084	24.9.38	126,861	— 1,117	13	1,521,651	1,515,633	+ 6,018	Ord. Stk.	33¾	13½	11	Nil
	Buenos Ayres Western	1,930	24.9.38	39,888	— 4,281	13	465,569	581,143	— 115,574	„	31¾	11¼	7½	Nil
	Central Argentine	3,700	24.9.38	107,965	— 17,047	13	1,287,061	1,705,423	— 418,362	„	34¼	10¾	7½	N..
	Do.	—	—	—	—	—	—	—	—	Did.	20½	4½	3½	Nil
	Cent. Uruguay of M. Video	972	17.9.38	15,583	— 1,387	12	186,548	179,063	+ 7,485	Ord. Stk.	6732	2	2	Nil
	Cordoba Central	1,218	—	—	—	—	—	—	—	Ord. Inc.	6¼	1½	3	Nil
	Costa Rica	188	July, 1938	23,262	— 1,426	5	23,262	24,688	— 1,426	Stk.	38	27	24	8516
	Dorada	70	Aug., 1938	17,600	+ 700	35	132,200	122,400	+ 9,800	1 Mt. Db.	107	106	105	51116
	Entre Rios	810	24.9.38	16,414	+ 2,276	13	196,549	181,114	+ 15,435	Ord. Stk.	19716	6	5	Nil
	Great Western of Brazil	1,092	24.9.38	7,500	— 300	39	246,400	279,000	— 32,600	Ord. Sh.	5¼	1⅛	1¼	Nil
	International of Cl. Amer.	794	July, 1938	$444,329	+ $26,759	31	$3,454,817	$3,543,958	— $89,141	—	—	—	—	—
	Interoceanic of Mexico	—	—	—	—	—	—	—	—	1st Pref.	2/-	1/-	1½	Nil
	La Guaira & Caracas	22¾	Aug., 1938	5,090	+ 10	35	40,670	43,200	— 2,530	Stk.	8½	6	8½	Nil
	Leopoldina	1,918	24.9.38	30,280	+ 3,502	39	781,293	897,518	— 117,225	Ord. Stk.	9¼	3	1½	Nil
	Mexican	483	21.9.38	$223,000	— $47,800	12	$3,067,400	$3,617,000	— $549,600	„	1½	1¼	1⅛	Nil
	Midland of Uruguay	319	Aug., 1938	8,857	+ 1,799	9	17,539	14,693	+ 2,840	„	1⅞	1½	1½	Nil
	Nitrate	386	15.9.38	4,021	— 3,639	37	105,183	113,641	— 8,458	Ord. Sh.	3116	2	1⅞	55116
	Paraguay Central	274	24.9.38	$2,883,000	— $136,000	13	$39,205,000	$42,252,000	— $3,047,000	Pr. Li. Stk.	84	79¼	57½	55116
	Peruvian Corporation	1,059	Aug., 1938	73,687	— 18,900	9	147,742	173,721	— 25,979	Pref.	14⅝	4½	1⅝	Nil
	Salvador	100	17.9.38	7,889	— 3,311	12	£133,665	£136,259	— £2,594	Pr. Li. Db.	23½	21½	22½	Nil
	San Paulo	153½	18.9.38	30,708	+ 2,560	38	1,187,355	1,224,332	— 36,977	Ord. Stk.	98½	56	32½	12½
	Taltal	160	Aug., 1938	2,710	— 1,845	9	6,220	7,495	— 1,275	Ord. Sh.	1716	1116	5¼	135116
	United of Havana	1,353	24.9.38	18,815	+ 3,231	13	212,615	227,769	— 15,154	Ord. Stk.	5⅝	3132	1	Nil
	Uruguay Northern	73	Aug., 1938	909	+ 103	9	1,783	1,593	+ 190	Deb. Stk.	10	2	2	Nil
Canada	Canadian National	23,750	21.9.38	794,321	— 38,507	38	24,868,496	28,039,583	— 3,171,087	—	—	—	—	—
	Canadian Northern	—	—	—	—	—	—	—	— 4 p.c.	Perp. Dbs.	77	62½	62½	6½
	Grand Trunk	—	—	—	—	—	—	—	—	4 p.c. Gar.	101⅞	94½	92½	4516
	Canadian Pacific	17,186	21.9.38	672,800	+ 15,000	38	18,990,400	20,065,800	— 1,075,400	Ord. Stk.	18	7¼	5	Nil
India†	Assam Bengal	1,329	10.9.38	36,795	— 46	23	605,174	577,806	+ 27,368	Ord. Stk.	86	73½	67½	4716
	Barsi Light	202	10.9.38	3,337	+ 1,112	23	66,307	59,482	+ 6,825	Ord. Sh.	66½	46	57½§	61516
	Bengal & North Western	2,116	10.9.38	61,594	— 2,162	23	1,241,474	1,322,241	— 80,767	Ord. Stk.	317	301	275	6916
	Bengal Dooars & Extension	161	10.9.38	4,448	— 463	23	61,552	61,728	— 176	„	100	84	84½	7½
	Bengal-Nagpur	3,268	10.9.38	165,225	— 11,996	23	3,036,111	3,084,450	— 48,339	„	101	89	86	458
	Bombay, Baroda & Cl. India	3,085	20.9.38	232,275	+ 17,700	24	4,031,700	4,117,800	— 86,100	„	113	110½	99½	6
	Madras & Southern Mahratta	2,967	10.9.38	129,000	+ 4,856	23	2,492,710	2,371,698	+ 121,012	„	110	105	99½	9116
	Rohilkund & Kumaon	546	10.9.38	11,716	— 626	23	250,782	252,917	— 2,135	„	314	302	285	6516
	South Indian	2,531¾	31.8.38	124,477	— 707	22	1,748,793	1,747,351	+ 1,442	„	103½	99½	97½	478
Various	Beira-Umtali	204	July, 1938	81,454	— 15,948	44	864,515	774,298	+ 90,217	—	—	—	—	—
	Egyptian Delta	620	10.9.38	6,276	— 232	23	90,715	96,372	— 5,657	Prf. Sh.	31/-	5¼	5¼	Nil
	Kenya & Uganda	1,625	Aug., 1938	182,150	— 14,527	35	1,860,357	1,920,155	— 59,798	—	—	—	—	—
	Manila	—	—	—	—	—	—	—	—	B. Deb	48⅛	43½	42½	814
	Midland of W. Australia	277	July, 1938	13,243	+ 2,998	5	13,243	10,245	+ 2,998	Inc. Deb.	98	93½	90	4716
	Nigerian	1,900	13.8.38	22,356	— 10,974	20	584,175	966,172	— 381,997	—	—	—	—	—
	Rhodesia	2,442	July, 1938	379,510	— 32,890	44	4,122,769	3,764,458	+ 358,311	—	—	—	—	—
	South Africa	13,263	10.9.38	622,163	— 19,212	24	14,366,082	14,808,280	— 442,198	—	—	—	—	—
	Victoria	4,774	June, 1938	719,210	— 74,013	52	9,735,075	10,135,291	— 400,216	—	—	—	—	—

NOTE.—Yields are based on the approximate current prices and are within a fraction of 1/16

† Receipts are calculated @ 1s. 6d. to the rupee § ex dividend

The variation in Sterling value of the Argentine paper peso has lately been so great that the method of converting the Sterling weekly receipts at the par rate of exchange has proved misleading, the amount being overestimated The statements are based on the current rates of exchange and not on the par value

Diesel Railway Traction

Diesel Fuels in America

JUDGING from data on diesel fuels given by Messrs. W. H. Hubner and G. Egloff in a paper before the American Society of Mechanical Engineers, there is certainly no such thing as a standard specification for railway oil engine fuels, and on scarcely any point are any two railways in agreement, even when the types of engines used are the same. On the viscosity (S.U.) basis at 100° F. the Gulf, Mobile & Northern Railroad calls for 60 sec. maximum, the Union Pacific 38 sec. maximum, and the Santa Fe 60 sec. maximum, but with the proviso that 38 sec. is desirable; the Burlington specifies 35 sec. minimum, and the New Haven 35 sec. minimum and 45 sec. maximum. Only three specifications mention the gravity A.P.I., the Burlington stipulating 32° minimum and 37° maximum, the Santa Fe 26° minimum, and the G.M. & N. 25° minimum. Amazing amounts of foreign matter are tolerated by some lines; for example, the New Haven permits up to 1·0 per cent. of sulphur, 0·5 per cent. of water and sediment, and up to 0·5 per cent. of carbon residue (Conradson), and the G.M. & N. allows up to 1·0 per cent. under all three headings. On the other hand, the Burlington allows only 0·5 per cent. of sulphur and 0·05 per cent. of carbon residue, and the Union Pacific specification is stricter still in allowing only 0·1 per cent. of sulphur, 0·01 per cent. of carbon residue, and no water or sediment. No railroad makes any ruling as to the ash content. The specified flash points are 150-190° F. on the Union Pacific, 150-175° F. on the Burlington, and 150° F. min. on the Santa Fe, New Haven, and G.M. & N. The Santa Fe and the Union Pacific specify a maximum pour point of zero degrees F., the Burlington −5° F., and the New Haven −25° F. in winter and 5° F. in summer. Only the Burlington makes any requirements as to the distillation characteristics, stipulating 425-500° F. at 10 per cent. and 540-620° F. at 90 per cent. The ignition qualities are specified only by the New Haven with a diesel index number of 45, and by the Santa Fe with a specified cetane number of 50. The Santa Fe is a large user of Winton engines, and tests have shown that if a lower number fuel than this is used the maintenance costs of the engine tend to rise.

Diesel Progress in Holland

ANOTHER great extension of diesel traction is to take place in Holland, and 20 five-car trains are to be acquired by the Netherlands Railways. Büchi pressure-charged Maybach 12-cylinder vee engines developing 600 b.h.p. at 1,400 r.p.m. are to be used, two to each train, and nine spare engines are to be supplied. All these engines are to be built by Werkspoor, which firm will also build the mechanical portions of the trains. The two remaining trains will be equipped with Stork-Ganz engines. Compared with the 40 three-car train sets put to work in 1934, the new five-car trains will have an installed horsepower of 1,200 compared with 820, and such a number of cars per train is well in accordance with Dutch practice, for the three-car sets have for long been worked as six, nine, and twelve-car trains by coupling them in multiple-unit. Such an order shows in no uncertain way that the difficulties encountered in 1934 have been overcome successfully, and the experience gained during the last four years should ensure that when the new trains are introduced a full regular service is possible straight away. The way in which the Dutch diesel trains are now operated is a credit to Mr. Hupkes, the Chief Mechanical Engineer, and his staff, and, incidentally, it may be noted here that Mr. Hupkes has just been made a vice-president of the executive committee of the Netherlands Railways, while retaining his post of Chief Mechanical Engineer. Another diesel field which is being pushed in Holland is the application of oil-engined locomotives to underground haulage in the State mines in the Limburg area. Here the four-wheeled 65 b.h.p. locomotives are built by Kromhout; in them are installed Gardner engines, made under licence in Holland, and also Vulcan-Sinclair fluid couplings. They are characterised by a low proportion of CO in the exhaust, and by the care taken to prevent any flames or sparks from reaching the atmosphere, even to the refinement of a device for automatically shutting down the engine if the exhaust temperature should be too high after passing through the conditioner.

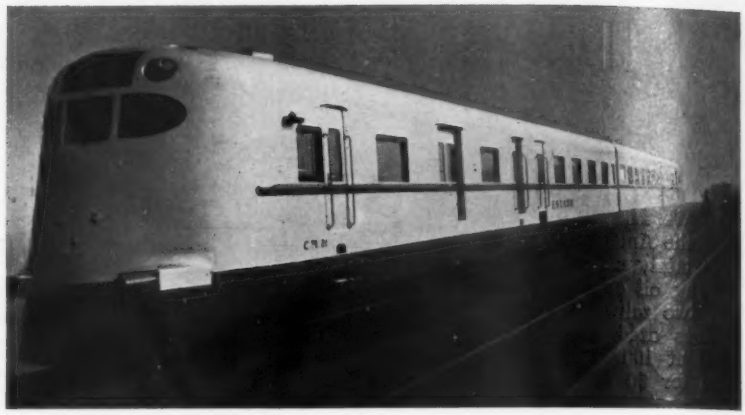
New Great Western Railcar Services

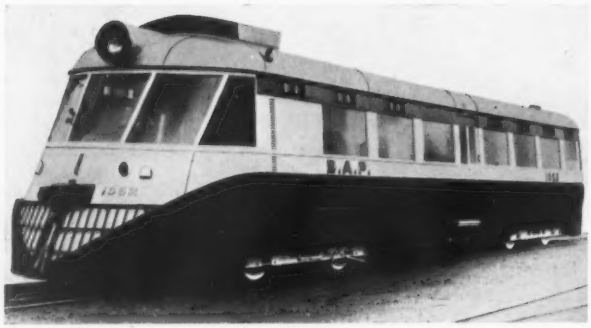
THE Great Western Railway, which now operates diesel railcar services over a total route mileage of nearly 800, will not considerably increase this figure when the 20 new diesel cars recently ordered are set to work, for in several areas the new vehicles will provide services, by replacing steam trains, over lines which already have one or more railcar services. Nevertheless, the aggregate mileage run by the railcars will advance to somewhere near twice the present mileage of 1,000,000 a year. According to present intentions, the 20 cars now being built conjointly at the company's Swindon works and the A.E.C. establishment at Southall will operate services on the following lines: Banbury—Kingham, Kidderminster—Bridgnorth, Leamington—Stratford—Honeybourne, Newport — Pontypool Road — Chepstow — Monmouth, Weymouth — Abbotsbury — Yeovil, Trowbridge — Devizes—Westbury—Chippenham, Frome—Castle Cary—Taunton, Banbury—Princes Risborough, and the Teign valley line. In addition, two sets of twin cars—close-coupled—will take over the present Birmingham—Cardiff buffet service, and the three present buffet railcars will be transferred elsewhere. These new twin sets will have a top speed of 70 m.p.h., against the 60 m.p.h. of two of the single-unit cars, and the 40 m.p.h. of the remainder. The streamlined contour will be slightly different from that embodied in the present cars, and the A.E.C. six-cylinder engine will be to a modified design. Two engines per car will be used, as before, but each engine will be set to give 105-110 b.h.p. at 1,650 r.p.m. as a maximum, contrasted with the 130 b.h.p. at 2,000 r.p.m. of the engines in the existing railcars. G.W.R. automatic train control apparatus will be incorporated.

XUM

GREAT DIESEL ADVANCE IN ARGENTINA

Well over 250 oil-engined locomotives and railcars are at work in, or about to be shipped to, Argentina, and further programmes of great magnitude are envisaged





Above: 620 b.h.p. Ganz diesel train for de luxe service on the State Railways' line between Viedma and the national park at Bariloche

Left: 120 b.h.p. Leyland diesel-hydraulic railcar for light service on the broad-gauge lines of the B.A.P. Railway

WITH the object of obtaining greater efficiency in operation in conjunction with lower working costs, all the Argentine railways are giving increasing attention to the possibilities which diesel traction offers in the way of securing both these ends.

Central Argentine Railway

On April 2 this railway put into operation in the Buenos Aires district the new diesel railcars recently constructed by Ganz, of Budapest. (See the *Diesel Railway Traction Supplement* for November 26, 1937.) The cars are partly replacing the present steam trains between Victoria and Capilla del Señor, and on April 15 (on which date the winter timetable came into force) an entirely new and improved service was introduced between Buenos Aires and Capilla (50 miles), eliminating the previous transhipment at Victoria and reducing the journey time in some cases by as much as 40 min. As more units are put into traffic accelerated services will be operated between Buenos Aires and Zarate (57 miles) on the main line to Rosario.

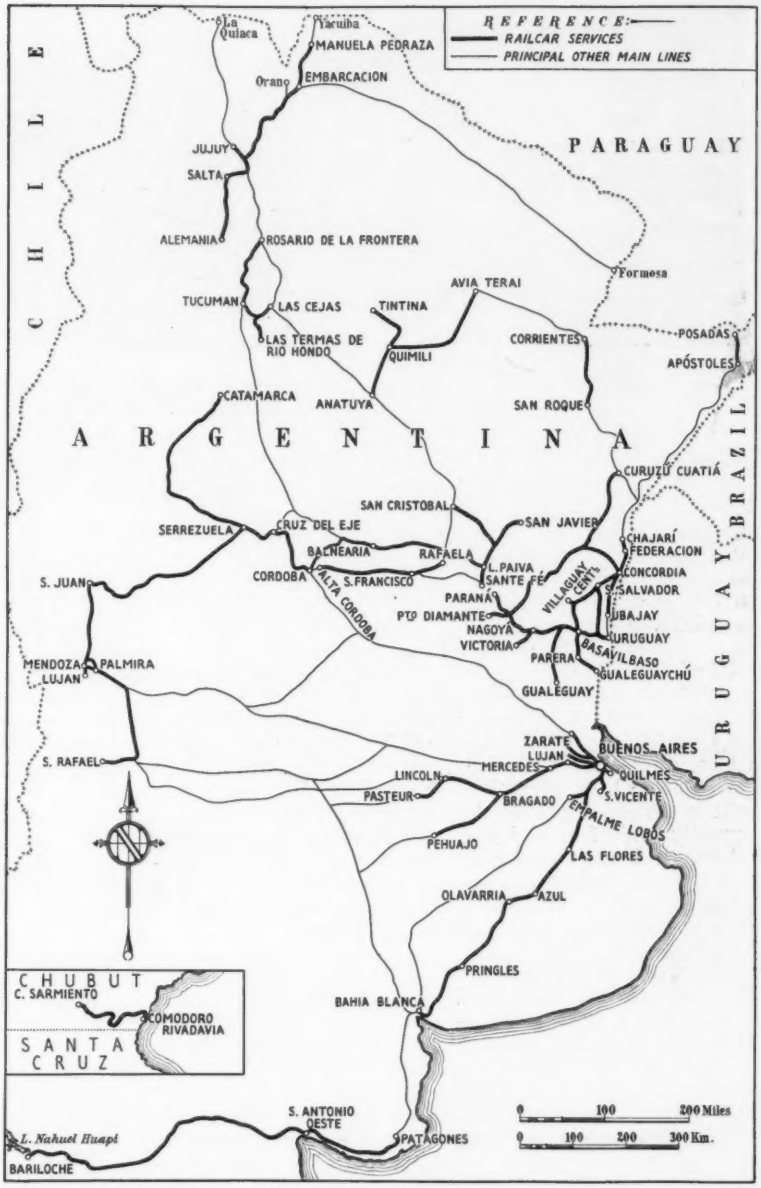
State Railways

With a view to accelerating the passenger services both on its own lines and those of the Cordoba Central (at present leased by the State Railways), the State Railways have incorporated in their winter timetable (beginning on April 15) a number of diesel units, distributed as follows: On the Cordoba Central seven cars—three twin-coupled and one single—are running from Buenos Aires to Boulogne and Del Viso, making 682 journeys in a week and covering a distance of 15,400 km. (9,600 miles); one single coach runs from Rafaela to San Francisco and Alta Cordoba, making 14 trips a week and covering 3,490 km. (2,160 miles).

On the Central North Argentine line, three single cars are running between Santa Fe and Laguna Paiva and San Cristobal, making 56 journeys a week; from Santa Fe to Alta Cordoba, there is one single coach in operation, making six journeys a week, and covering 2,568 km. (1,590 miles). From Balnearia to Alta Cordoba, one single coach is making 14 journeys a week, with a total run of 2,196 km. (1,340 miles); from Cordoba to Capilla del Monte and Cruz del Eje, four coaches—two twin-coupled and two single—are making 38 journeys weekly, equivalent to 5,919 km. (3,675 miles); from Cordoba to Catamarca, one coupled coach makes four journeys a week, 2,492 km. (1,545 miles); from Salta and Campo Quijano to Alemania, three single coaches operate 68 journeys a week, 3,307 km. (2,045 miles); from Salta to Jujuy, three single coaches make 30 journeys a week, 3,136 km. (1,940 miles); and from Salta to Manuela Pedraza, one single coach makes four journeys a week, 1,440 km. (895 miles).

On the Eastern line, from Puerto Diamante to Concordia, there is one single coach making six journeys a week, equivalent to a total of 2,084 km. (1,300 miles). On the Patagonian lines a single railcar is in operation between Patagones and San Antonio Oeste, making two journeys a week, with a total run of 402 km. (250 miles); and from Comodoro Rivadavia to Colonia Sarmiento a single railcar makes six trips a week, 1,182 km. (735 miles). The three-car trains described in the issue of this Supplement for April 15 are operating the *de luxe* sleeping car service over the 500-mile Viedma—Bariloche route.

The State Railways have at present in actual operation 43 Ganz diesel railcars or railcar trains—38 on the C.N.A. line (metre gauge); two on the Eastern line (4 ft. 8½ in. gauge) and three on the Patagonian lines (5 ft. 6 in.



Map showing lines in Argentina over which diesel-worked services—by railcar, train, or locomotive—are operated. The lines comprise 5 ft. 6 in., 4 ft. 8½ in., and metre gauges, and the railways involved are the State lines, Central Argentine, Buenos Ayres Great Southern, Buenos Ayres Western, Entre Rios, Argentine North Eastern, Buenos Ayres Pacific, and Buenos Aires Provincial systems. Most of these railways intend to increase their diesel stock, and in addition a further line, the B.A. Midland, has some twin-articulated sets on order in England

gauge). Forty more of these units are due to arrive shortly—34 for use on the narrow-gauge lines, four for the standard gauge, and two triple-car trains for service on the broad-gauge line to Nahuel Huapi.

More recently, the Argentine State Railways have ordered seven more triple-car Ganz trains for metre-gauge lines, principally those now being taken over with the Cordoba Central Railway. Five of the trains will work in suburban service, and the remaining two will operate a semi-*de luxe* service between Cordoba and Catamarca.

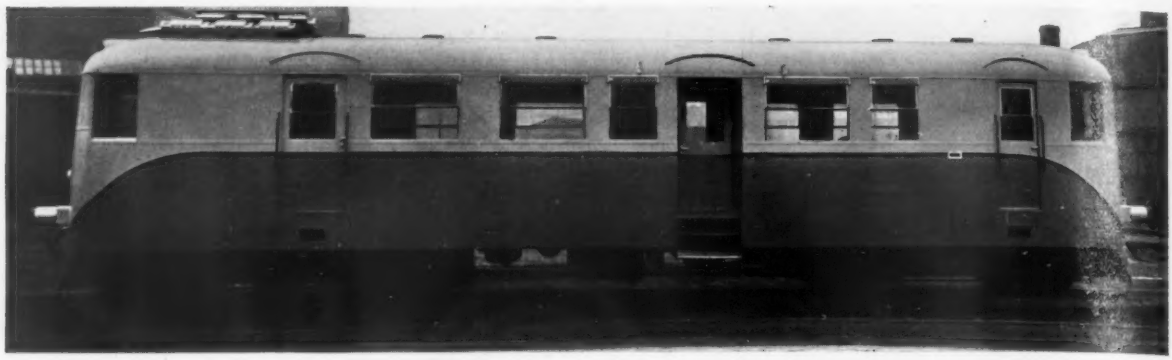
Entre Rios and Argentine North Eastern

At the moment, all the diesel railcars are used on the Entre Rios lines and the lighter railbuses on the Argentine North Eastern system. The main railcar services run between Paraná and Uruguay, and between Concordia and Gualeguaychú, there being a coach in each direction on each of these runs daily. Timetables are arranged so that the four coaches cross in Basavilbaso, thus providing the maximum combinations possible. Other diesel railcars are employed on the more important branches, such as Concordia—Uruguay *via* San Salvador and Caseros, and Gualeguay-Tala, and a further coach is used on a local service from Victoria-Nogoyá to Paraná.

The diesel railbuses are utilised to provide a local service concentrating on the larger towns. At the moment they are concentrated on Corrientes, Posadas, and Concordia. In all cases there is a morning service to the centre and a late afternoon service from the centre to the local section. When the present programme is completed there will be diesel services aggregating 18,670 km. (11,600 miles) a week on the Entre Rios lines and 8,700 km. (5,400 miles) on the Argentine North Eastern system.

Buenos Ayres Pacific

The six railcars operating on this line—three with mechanical and three with hydraulic transmission—were described in the issue of this Supplement for February 18, 1938. These cars are operating passenger services over the broad-gauge Mendoza—San Rafael, Mendoza—Palmira.



One of the 100-odd Drewry diesel-mechanical railcars with Gardner engines, Vulcan-Sinclair fluid couplings, and Wilson gearboxes for the Buenos Ayres Great Southern and associated lines

and Mendoza—Lujan circuit services. Two 130 b.h.p. Leyland diesel-hydraulic railcars are also at work on the B.A.P. Railway. It was proposed to requisition during this year a total of 14 diesel railcars generally similar to those now operating in the Mendoza area, but owing to the general state of trade and exchange difficulties, sanction for the purchase was withheld by the debenture-holders' committee.

B.A.G.S. and B.A. Western

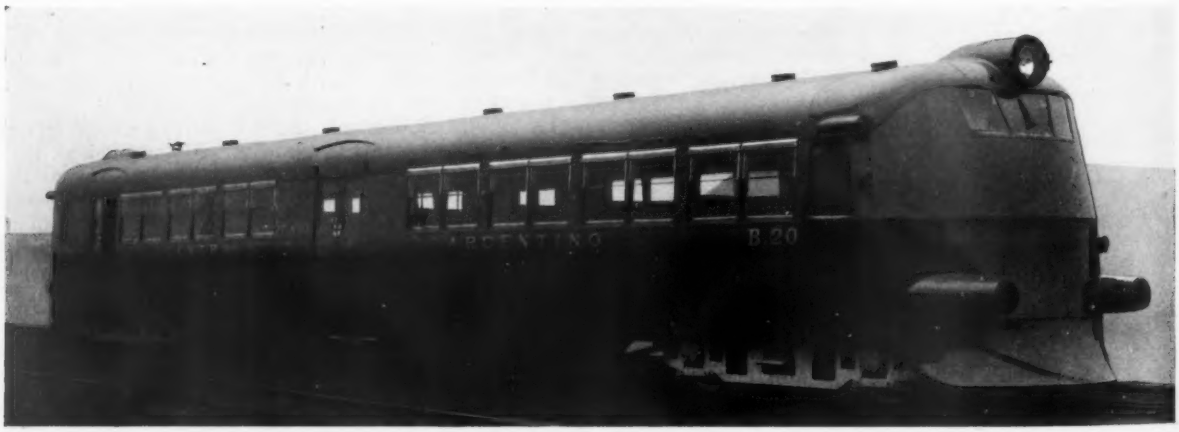
Of all diesel activities in Argentina, those of the Buenos Ayres Great Southern Railway probably are best known, for they date back to 1929, and the stock includes such large vehicles as 1,700 b.h.p. mobile power houses and a locomotive with a similar output. Two 1,200 b.h.p. mobile power houses built in 1929 and three of 1,700 b.h.p. built in 1932-33 are engaged in heavy suburban services—normally with five and eight coach trains respectively—between Plaza Constitucion terminus in Buenos Aires and Quilmes and San Vicente, and on the "circuito" suburban route. The three larger units normally work 44 suburban trains a day with a combined mileage of 1,038 km. (641 miles).

The first diesel locomotive of the B.A.G.S., the Beardmore-engined 375 b.h.p. bogie unit, has been worked on a variety of services since its introduction in 1929, such as Buenos Aires to Chascomus (passenger), Buenos Aires to Mar del Plata (fish), Temperley to Tristan Suarez (passenger and parcels), and on the Lezama line (parcels and milk). The 420 b.h.p. Sulzer-engined locomotive set to work at the same time is now operating on the Temperley—Suarez section with certain trips to Buenos Aires. The 1,700 b.h.p. main line diesel-electric locomotive has operated on express trains over the Buenos Aires—Bahia Blanca main line most of its working life. Four other 800-900 b.h.p. locomotives have been acquired during the last few months for main line work. A great extension of diesel-worked branch line services is now being made with the gradual introduction of the 99 Drewry diesel-mechanical railcars on this and the associated B.A. Western Railway.

Extremely satisfactory service has been obtained on the Buenos Ayres Western Railway with the 450 b.h.p. Armstrong-Whitworth diesel-electric railcar, in which the power bogie is articulated to the passenger portion. It operates over the line from Once terminus in Buenos Aires to Pehuajo, and from Bragado, on this line, other railcars work to Lincoln and Pasteur. Another associated line, the B.A. Midland, is to put into traffic a batch of twin-articulated cars having the standard Gardner engine.

Other Services

The Buenos Aires Provincial Railways have had in passenger service since the beginning of 1936 four Sulzer 270 b.h.p. diesel-electric railcars. They operate in the vicinity of the Argentine capital. Three heavy double bogie shunting locomotives with Sulzer engines have been in operation on the wharves of the Port of Rosario authorities since 1931, and three with M.A.N. engines at the Port of Buenos Aires since 1929. The M.A.N. engines are of the six-cylinder 300 b.h.p. type.



Birmingham 275 b.h.p. railcar with Armstrong-Sulzer engine, Central Argentine Railway

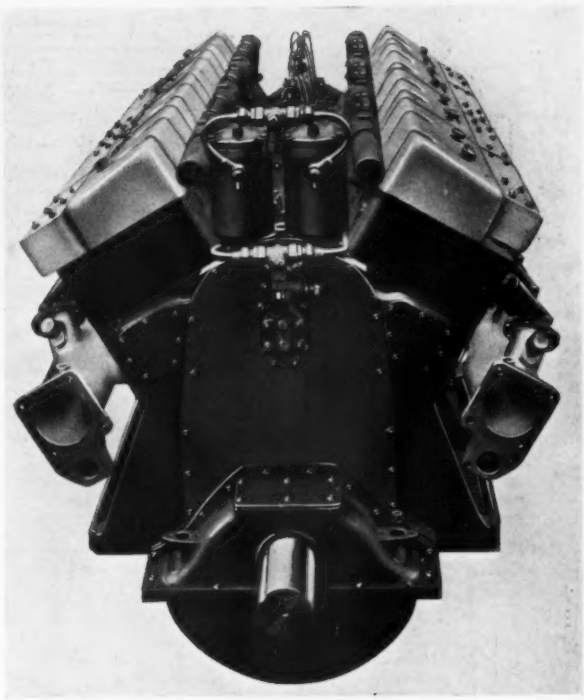
ENGLISH 1,000 B.H.P. HIGH-SPEED ENGINE

HITHERTO the largest high-speed engine, say over 1,200 r.p.m., suitable for rail traction work has had an output of 600 to 650 b.h.p. when supercharged, but a tremendous step forward has been made in this field by the introduction of an engine with a maximum output of 1,000 b.h.p. unsupercharged at 1,750 r.p.m. by Davey, Paxman & Co. (Colchester) Ltd. Although designed originally for application to marine propulsion where the installation had to be made in very light hulls, the weight and bulk characteristics and the engine interior accessibility are of the order required for rail traction service. Indeed, in the weight direction, a reduction of over 30 per cent. in the specific weight compared with any engine actually in railway service has been achieved, for in the dry condition and without flywheel the engine scales only $5\frac{3}{4}$ lb. per b.h.p. when a light alloy crankcase is used.

Range of Vee Engines

This new 16-cylinder vee engine is the highest development of the Paxman-Ricardo RB range now comprising 8-, 12-, and 16-cylinder engines, all with a standard cylinder size of 7 in. bore by $7\frac{3}{4}$ in. stroke. For convenience, the outputs and weights of all are given in the accompanying table. At the top output the piston speed is 2,260 ft. per min. and the m.e.p. 95 lb. per sq. in., and as the mechanical efficiency of the engine at full load and speed is in the neighbourhood of 75 per cent., the mean indicated pressure is 127 lb. per sq. in. Actually, on test, mean *effective* pressures of 131 lb. per sq. in. at 1,000 r.p.m. and 126 lb. per sq. in. at 1,500 r.p.m. have been obtained, and if a mechanical efficiency of 78 to 79 per cent. at 1,500 r.p.m. is assumed, the mean indicated pressure at that speed would be about 160 lb. per sq. in.; all these figures were obtained without supercharging, which means that the normal useful maximum service output of the engine may yet be increased from 800 b.h.p. at 1,500 r.p.m. to something like 1,100 b.h.p. at the same speed and without any increase in the cylinder maximum pressure. The compression ratio is 15·2 to 1, the compression pressure about 550 lb. per sq. in., and the maximum combustion pressure about 850 lb. per sq. in. With a piston-swept volume of 78 litres, the output per litre is a maximum of 12·8 b.h.p. at 1,750 r.p.m. It is claimed that at all loads up to 1,000 b.h.p. the exhaust is invisible. We understand that when supercharged to a pressure of 21 lb. per sq. in. absolute operation at 1,750 r.p.m. can be conducted with a mean effective pressure of 150 lb. per sq. in.

It was decided in the design stage that, as the engine would frequently be used in hulls or on bases with some flexibility, it should be stiff enough to absorb its own internal reactions without outside support, and to permit of slight relative movement between the engine and the seating a semi-flexible mounting of the Silentbloc type was considered as a standard. To carry these Silentbloc bushings as far apart as possible, and thus ensure steadiness, a wide and deep flange is provided along each side of the engine, and this also gives extreme lateral stiffness. For easy servicing of the engine, either in a yacht or in a rail-car or locomotive, the engine is arranged so that the pistons and double connecting rods can be removed through large doors in the crankcase. Such a layout also improves the accessibility of the main bearings. It is not necessary to remove the water from the jackets or disturb any part of the valve gear when pistons or connecting rods are removed.



End view of Paxman vee engine

Ricardo Heads

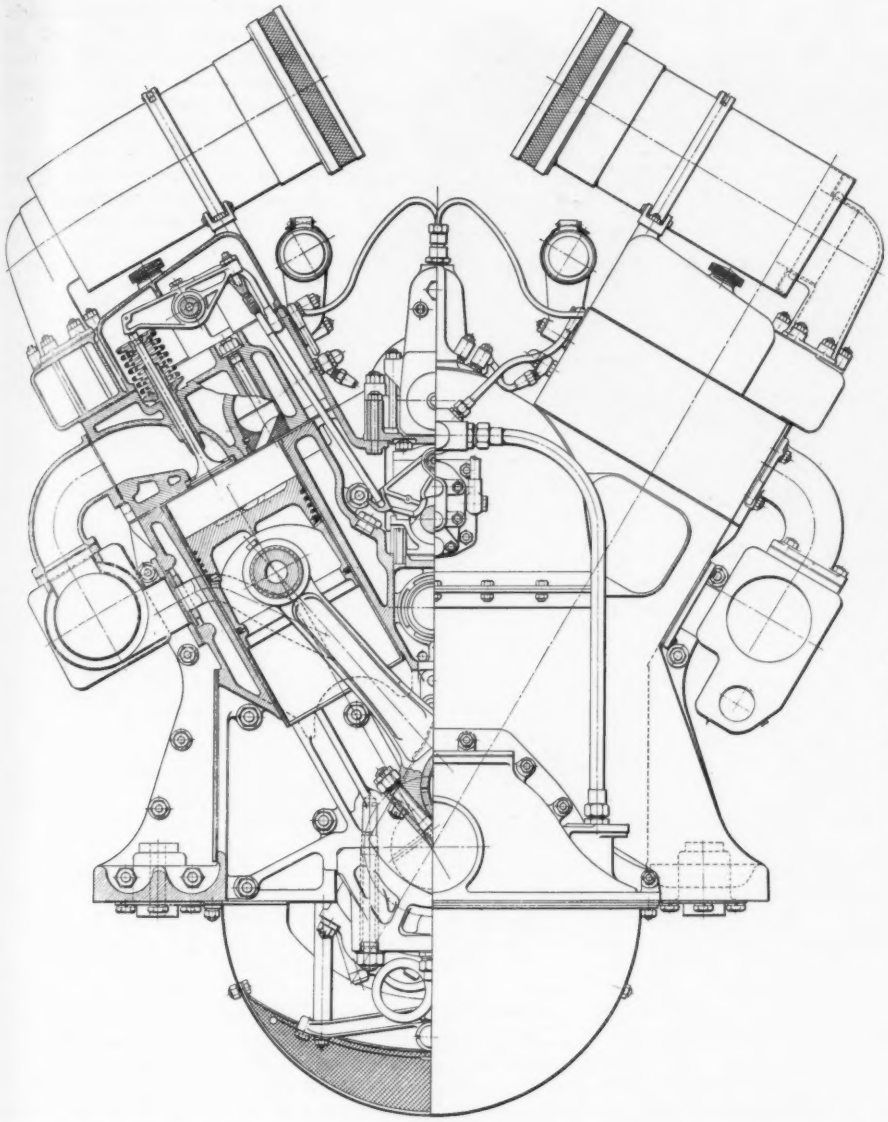
Incorporated in the cylinder heads are Ricardo Comet Mark III combustion chambers (see issue of this Supplement for October 29, 1937). This particular form of air cell was developed from the earlier Ricardo heads in order to gain an improvement in thermal efficiency and thus counteract to some extent the fuel oil tax. Approximateiy

PAXMAN–RICARDO VEE ENGINE, POWERS AND WEIGHTS

Type No.	No. of cyls.	Cyl. bore and stroke. In.	B.H.P. At 1,000 r.p.m.	B.H.P. At 1,250 r.p.m.	B.H.P. At 1,500 r.p.m.	B.H.P. At 1,750 r.p.m.	Light weight. Lb. Cast iron construction.	Light weight. Lb. Light alloy construction (standard).	Light weight. Lb. Light alloy construction (special).	Flywheel weight (extra). Lb.
8 VRB	8	7 in. by $7\frac{3}{4}$ in.	265	335	400	500	5,000	3,000	2,700	440
12 VRB	12		400	500	600	750	6,700	4,350	3,740	440
16 VRB	16		535	665	800	1,000	8,600	5,600	4,860	440

This engine develops a maximum of 1,000 b.h.p. at 1,750 r.p.m., in 16 cylinders, 7-in. bore by 7¾-in. stroke. When built to light alloy construction, the weight is less than 6 lb. per b.h.p. The crankshaft has a diameter of 4½ in., and is made of 55-ton heat-treated nickel-chrome steel. The connecting rods are of 40-ton steel, and the motion of one rod end relative to that of its opposite number is purely oscillating; the big-end bearing pressure is about 2,300 lb. per sq. in. without making a deduction for the inertia forces. The plain rods weigh 8 lb. and are 16 in. long. Dry-type liners, ⅛ in. thick, are inserted in the cylinder block, and weigh 10 lb. each. Each cylinder head contains one inlet and one exhaust valve, but the inlet valves are considerably larger than the exhaust, in order to give the highest possible volumetric efficiency

LONGITUDINAL SECTION OF PAXMAN-RICARDO 16-CYLINDER VEE ENGINE



Cross-section of the Paxman-Ricardo vee engine designed for running up to 1,750-r.p.m. An interesting point in the design is the Y-alloy piston arrangement. The pistons are provided with high-expansion cast iron inserts, which carry the top pressure ring. The insert serves to resist the hammering and sliding effects of the top ring in its groove, and to lower the temperature of that ring. For high outputs and speeds it has been found advantageous to make the pressure rings of taper section, as by doing this it is possible to prevent ring sticking. A vertical clearance of 0·001 to 0·0015 in. is given, and the angle of taper is greatest for the highest outputs

half the total clearance volume is located in the spherical air cell and about half in a slight depression in the piston top and in the clearance between the piston crown and the underside of the cylinder head. The efficient combustion range provided by this type of head has allowed of the full speed range from idling at 300 r.p.m. to full load at 1,750 r.p.m. to be brought under the control of a single fuel lever, without any advance or retard mechanism. The use of this form of combustion chamber enables the maximum gas pressure to be kept nearly constant over a wide range of load, and allows of a low injector pressure.

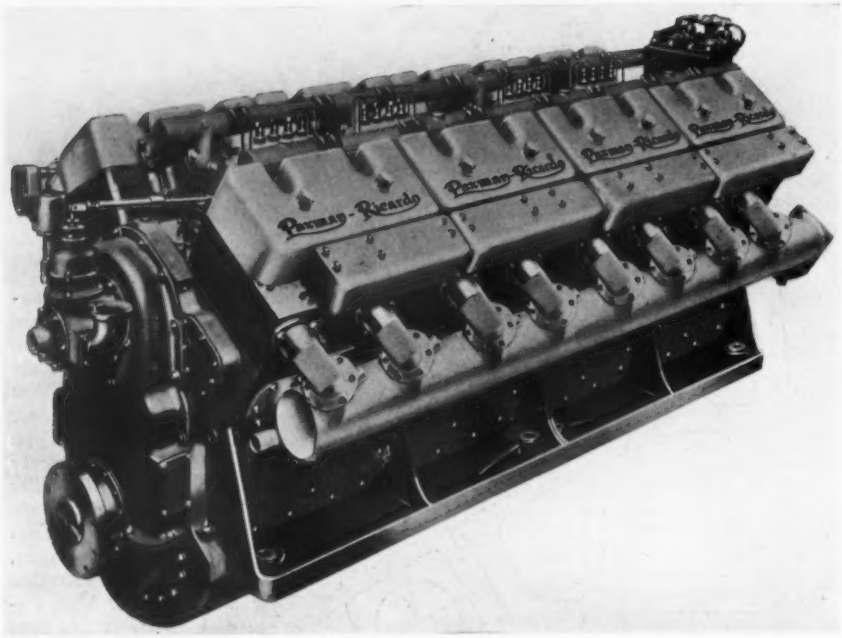
Engine Construction

The 16 cylinders are arranged in two banks of eight with an included angle of 60 deg.; in order to keep down the overall length of the engine to a minimum, simplify the main frame casting, and at the same time provide ample bearing surfaces, the cylinders are exactly opposite to one another, and the connecting rods of one bank are forked over those of the other, which incidentally gives equal strokes to the pistons of both banks. The cylinder block and crankcase above the crankshaft centre line are combined in an integral casting of Hiduminium RR.50 aluminium alloy, but cast iron can be used where weight limitations are not severe. This main casting carries the crankshaft through nine underslung bearings with caps of heat-treated Hiduminium RR.56 forgings. The lower part of the crank chamber is in the form of a separate light-weight sump.

Hiduminium RR.50 light alloy is used for the cylinder heads, which are cast in pairs for the eight-cylinder and 16-cylinder engines, and in threes for the 12-cylinder model. They are machined to limit gauges and fitted to the top of the cylinder block by studs. In each cylinder head is carried one inlet and one exhaust valve, and the whole 32 are driven by one chain driven camshaft located in the vee between the two banks of cylinders. As it is not necessary to remove the cylinder heads to get access to the pistons, Stellited inserts have been used in the cylinder heads and the valve seats have been Stellited, so the grinding of the valves and seats should not be necessary except after very long intervals. The hardened cams are integral with the camshaft and drive the valves through pressure-lubricated rockers and short ball-ended Duralumin push rods. The overhead valve gear is entirely enclosed in magnesium alloy oil-tight and dust-tight covers.

LONGITUDINAL SECTION OF PAXMAN-RICARDO 16-CYLINDER VEE ENGINE

XUM



***Paxman-Ricardo** 16-cylinder lightweight engine as designed for quick-running marine and railway applications. At the maximum unsupercharged output of 1,000 b.h.p., the speed is 1,750 r.p.m., but a maximum supercharged output 50 per cent. in excess of this figure, at the same rotational speed, is believed to be practicable*

Four special light-weight single-block four-ram C.A.V.-Bosch fuel pumps supply the fuel to single-hole self-cleaning pintle-type atomisers located in the Comet air cells, and which have a spring set to 1,500 lb. per sq. in. The fuel pumps are located in the vee between the cylinders, but above the main camshaft; the drive is taken from this camshaft at the engine centre, and the two pumps to each side are driven in tandem. The fuel pressure at an engine speed of 1,500 r.p.m. is about 3,000 lb. per sq. in., and at 1,000 r.p.m. about 2,500 lb. per sq. in.

Dry-type cylinder liners of pearlitic cast iron are inserted in the cylinder block, and are accurately honed and interchangeable. In them run Y-alloy pistons fitted with taper section rings which obviate any tendency to sticking; four pressure and three scraper rings are used. The uppermost pressure rings are fitted into special high-expansion iron inserts cast into the piston to resist wear in the ring grooves. Fully-floating casehardened nickel steel hollow-bored gudgeon pins transmit the drive through chill-cast phosphor-bronze floating bushes to the drop-forged I-section connecting rods, which are of 40-ton nickel steel. The big-end bearing shells for each crankpin are common to the two rods driving that pin, and the steel bushes are lined inside and outside with whitemetal. The crankshaft is a single forging of heat-treated nickel-chrome steel, and the crankpins are hollow-bored. The main bearings have loose steel shells lined with anti-friction metal, and one of them acts as a thrust bearing. A 55-ton heat-treated nickel-chrome steel is used for the crankshaft when the lightest possible engine is desired.

Lubrication System

Lubrication is competely automatic on a high-pressure system working normally at 50 lb. per sq. in. Cooled oil is forced by a pump through a filter, and then along a common rail from which leads are taken to each main bearing; a proportion of the oil to the main bearings is led through holes drilled in the crankshaft to the crankpin bearings. Oil thrown from the big ends lubricates the cylinder liners and gudgeon pins. From this high-pressure circuit oil is taken through a reducing valve to a secondary low-pressure system which feeds oil to the overhead rocker gear, camshaft, and similar parts, and the surplus oil returns to the sump by gravity through internal passages. The pumps maintaining the lubricating and governor oil systems are of the valveless gear type, and are two in number—one pressure and one scavenge.

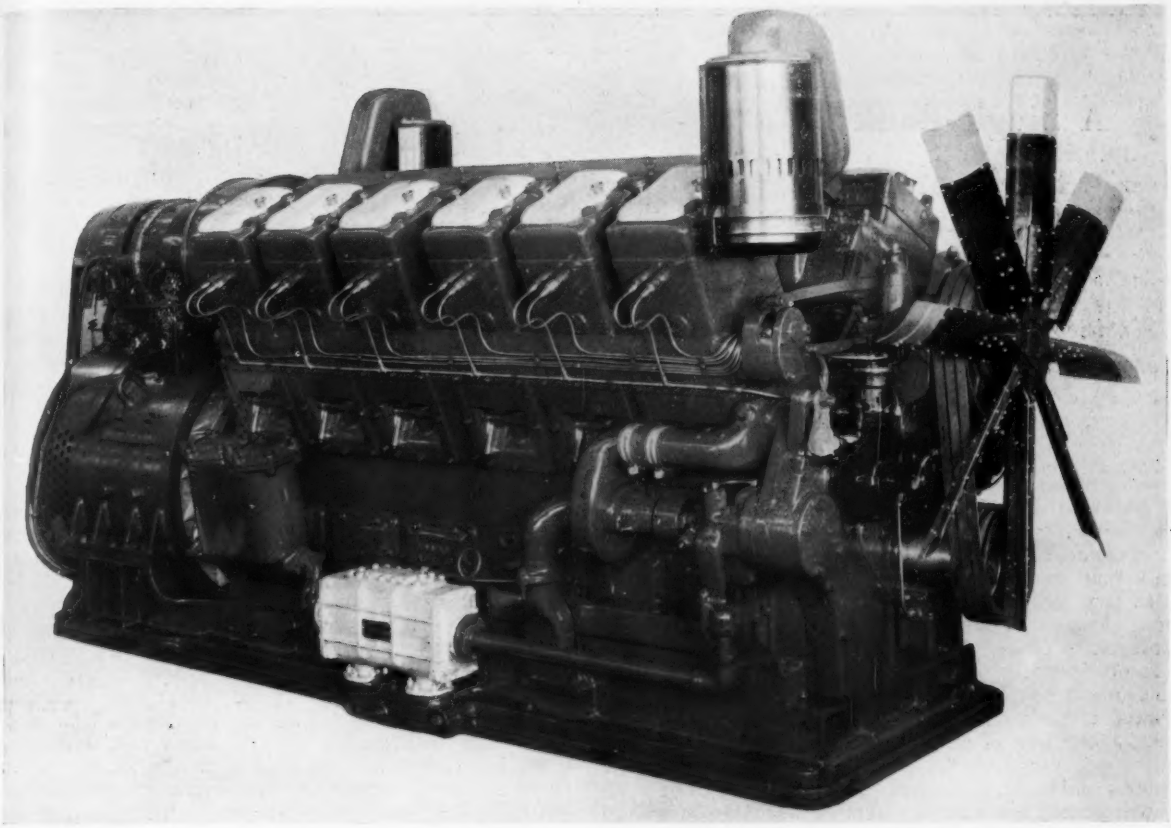
A supply of oil is taken from the main lubricating system to provide the operating power for the patent double servo centrifugal governor, which is contrived so that a fall in lubricating oil pressure below a certain predetermined figure brings the engine automatically back to idling speed. Moreover, the construction of the governor enables the engine speed to be varied instantly from idling to full load with only finger and thumb control, and the power on the fuel pump is maintained irrespective of the engine speed.

Water-cooled exhaust manifolds of Birmabright light alloy are provided, and are arranged at the sides of the engine below each bank of cylinder heads. The cooling water manifolds are in the central vee, and the air induction manifolds, made of magnesium alloy, are along the outside of the cylinder head casings. An engine-driven cooling water pump is mounted at the end of the engine remote from the driving end and delivers the water from the radiator first through the exhaust manifold, then to the jackets, and *via* the cylinder heads to the outlet manifolds; the temperature control is thermostatic. Starting can be effected either electrically or by air, as desired; in the former case 24-volt current is used for the starting motor, which operates through the usual Bendix drive. When air is used it is standard practice to admit the air to the cylinders through a reducing valve set to about 400 lb. per sq. in.

Fuel consumption over the normal working range is remarkably constant, but is not unduly low, being about 0·41 lb. per b.h.p.hr. at 1,000 b.h.p. at 1,750 r.p.m. When running at 1,600 r.p.m., the fuel consumption is below 0·405 lb. per b.h.p.hr. for mean effective pressures between 70 and 97 lb. per sq. in., and when operating at 1,400 r.p.m. is below 0·405 lb. per b.h.p.hr. at all m.e.p.'s between 65 and 97 lb. per sq. in. On the test bed it was proved that at these speeds the maximum cylinder pressure varied only between the limits of 790 and 830 lb. per sq. in. for mean effective pressures over the range of 70 lb. to 110 lb. per sq. in.

AMERICAN 500 B.H.P. FOUR-STROKE ENGINE

Special Cummins features incorporated



Cummins 500 b.h.p. four-stroke engine attached to American General Electric main generator carrying a belt-driven auxiliary generator and with a directly connected traction motor blower set

AMONG the four-stroke engines now being used for rail traction work in the U.S.A. is the Cummins 12-cylinder vee engine. One application is to a rail-car with post office and baggage compartments and which normally hauls one passenger trailer. This has been in operation between Kansas City and St. Louis for about 18 months, and is understood to be saving the railroad about $550 a month compared with a petrol-engined rail-car running in the same service. Two of these engines are also installed in an 89-ton double-bogie diesel-electric shunting locomotive of the Chicago, Burlington & Quincy Railroad, which is a development of the 500 b.h.p. locomotive illustrated and described in the issue of this Supplement for August 9, 1935.

The 12 cylinders have a bore of 7 in. and a stroke of 10 in., and are set in two banks with an included angle of 50 deg. An output of 500 b.h.p. is developed at 1,000 r.p.m., giving characteristics of 86 lb. per sq. in. m.e.p. and 1,665 ft. per min. piston speed. In the C.B. & Q. locomotive, which is used by the Burlington's subsidiary line, the Fort Worth & Denver City Railroad, the engine is mounted on a welded steel underbed which carries the main generator and certain auxiliaries. As may be seen from the accompanying illustration, an endeavour has been made to arrange the engine, generator and as many auxiliaries as possible in a single compact unit; this is a feature of Cummins' installations generally. Actually, the engine is 8 ft. 9 in. long over crankshaft flanges, 6 ft. 3 in. high overall 5 ft. 1 in. high from base to top of cylinder cover casings, 1 ft. 8½ in. deep below crankshaft centre line, 4 ft. 2 in. wide over cylinder covers at top, and 4 ft. 8½ in. wide over air filters. The dimension last given depends upon the type of air filter.

This vee engine is a development of the maker's straight-six 250 b.h.p. engine as illustrated and described in the issue of this Supplement for November 26, 1937. The crankcase and cylinder block are cast in one piece and wet-type liners are inserted. The cylinder heads are individual castings and contain one inlet valve, one exhaust valve, and a Cummins fuel injector. Chrome-nickel iron is used for the pistons, which carry five pressure and two scraper rings. Included in a standard assembly are a governor, fuel oil filter, fuel oil pressure gauge, lubricating oil filter, flywheel (only where necessary), water pump assembly, fuel priming pump, lubricating oil pressure gauge, and a silencer.

Another technical feature of the engine is the Cummins fuel pump and injection arrangements, which include a gear pressure pump for maintaining a supply of fuel at constant pressure on the suction side of the metering

plunger. Normally, there is only one metering plunger per engine, and thus every cylinder receives the same charge of fuel for a given setting of the fuel control. This plunger is driven by the fuel pump camshaft, which turns at crankshaft speed, and has as many lobes on the cam as there are power impulses per crankshaft revolution. The fuel passed by the metering plunger is delivered through a distributor arranged to choose the proper cylinder for each individual fuel delivery. Finally, the atomiser in the cylinder head is of a special design which vaporises the fuel charge before its delivery into the combustion chamber.

A Single-Bank Horizontal Railcar Engine

Sensitive hydraulic governing over speed range of 400 to 2,000 r.p.m.

ANOTHER horizontal engine for light railcar work has been introduced, this time by the Humboldt-Deutzmotoren A.G. Like the Leyland road transport and the Vomag engines it has only one bank of cylinders, and is, in fact, simply the Deutz eight-cylinder vertical high-speed engine turned over on its side and with the absolute minimum of changes.

The principal alteration is in the sump, which previously was simply an oil trough, whereas now it must assist the crankcase in its function as the engine framework. It is now of cast iron, and large inspection doors in the side (or what in a vertical engine would be the bottom) enable the connecting rods and pistons to be withdrawn without breaking the joint between the sump and the crankcase. Another alteration is in the position of the fuel pump, which became located on the underside when the engine was turned over; the pump, of Deutz manufacture, has been transferred to one end, and is now driven directly by the camshaft. Similarly, the air, lubricating oil, and fuel filters have been mounted at the same end, so that all parts needing inspection or replacement are located together in a convenient position. On account of the horizontal position, the valve stems and rockers have been connected to the pressure lubrication system. The Deutz fuel pump is interchangeable in its attachment with the proprietary fuel pumps.

Eight cylinders 130 mm. by 170 mm. (5·12 in. by 6·7 in.) are used, and they are fitted with precombustion chamber heads cast individually. At the top speed of 1,600 r.p.m. the engine output is limited to 175 b.h.p. for railway applications, but the maker sets the engine to 200 b.h.p. at the same speed for road or other purposes. The weight with electric starting motor and dynamo is 1,300 kg. (2,870 lb.), equivalent to 16½ lb. per b.h.p. for the railway engine. The overall dimensions are 620 mm. (24½ in.) high, 1·275 m. (4 ft. 2½ in.) broad, and 2·5 m. (8 ft. 3 in.) long. At the top railway output of 175 b.h.p. at 1,600 r.p.m. the fuel consumption is 203 gr. per b.h.p.hr., the m.e.p. 77 lb. per sq. in. and the normal exhaust temperature about 450° C. The minimum fuel consumption is 200 gr. per b.h.p.hr. over the range of 150 b.h.p. at 1,225 r.p.m. to 165 b.h.p. at 1,400 r.p.m. The point of maximum torque and m.e.p. is 1,120 to 1,140 r.p.m.

Producer-Gas Locomotives

In conjunction with the Kämper-Motoren A.G. and the Wisco-Fahrzeuggasgeneratoren Kom.Ges., the Berliner Maschinenbau A.G. has developed for the German State Railway a suction-gas loco-tractor, the first of which has now been in service for over a year. In this locomotive, the gas producer is mounted forward and to the left, outside the locomotive frame, an arrangement convenient for the conversion of existing loco-tractors to operation on suction gas. Subsequently an order was placed for five gas-driven loco-tractors, and in these the producer is mounted on the cab platform. These locomotives are fitted with a Voith fluid transmission, and the only external difference between them and ordinary light locomotives lies in the bunker projecting through the roof of the cab and the cooling coil for the surplus steam generated in the course of the production of the gas. With this arrangement, a supply of semi-coke can be carried, and the driver can attend to the grate and to the charging of fuel to the producer without leaving the cab.

The locomotives are ready for service about 10 min. after firing-up the cold producer. Fuel costs are about 30 per cent. of those for diesel operation under German conditions, and as the brown coal semi-coke is a by-product of certain processes for the manufacture of liquid fuels, its use in locomotive service improves the overall economic results of the fuel-processing operations, while leaving the output of liquid fuel free for other applications.

AUSTRIAN RAILCAR WORKS.—The Simmering Waggon & Maschinenbau A.G. and the Steyr–Daimler–Puchwerke A.G., both of which have supplied numerous railcars to the erstwhile Austrian Federal Railways, have been absorbed, along with other factories, into the German State undertaking known as the Reichswerke A.G. Hermann Göring.

Express Railcar Mileage

THE 275 b.h.p. Arpad diesel-mechanical railcars designed and built by Ganz for the Hungarian State Railways began regular service in the summer of 1934, the run first inaugurated being that between Budapest and Vienna, 168 miles, which is made at an average of about 57 m.p.h. including a 3-min. stop at Hegyeshalom, reduced speed through Komárom and Győr and with a maximum permissible speed of 75 m.p.h. The scheduled time over the 116·6 miles between Budapest (Ost) and the frontier station at Hegyeshalom is 124 min. As further cars were put into traffic, new services to such places as the Lake Balaton resorts and Miskolc were introduced, and there are now six of these express railcars at work. The accumulated mileage is now over 1,000,000, and the details to the beginning of this year are shown in the accompanying table.

MILEAGE OF THE SIX ARPAD DIESEL-MECHANICAL GANZ RAILCARS OF THE HUNGARIAN STATE RAILWAYS

Car No.	20	21	22	23	24	25
First trip	June 2, 1934	Sept. 24, 1934	June 12, 1935	June 18, 1935	June 14, 1937	June 14, 1937
1934	17,015	8,431	—	—	—	—
1935	57,270	59,675	15,335	19,051	—	—
1936	49,955	66,131	73,577	66,800	—	—
1937	66,063	55,116	59,265	83,417	49,709	51,244
1938. Until February 28	13,469	15,323	5,332	10,190	19,192	17,597
Total	203,772	204,676	153,509	179,458	68,901	68,841
First main overhaul after miles run	85,485	68,106	148,177	179,458	—	—

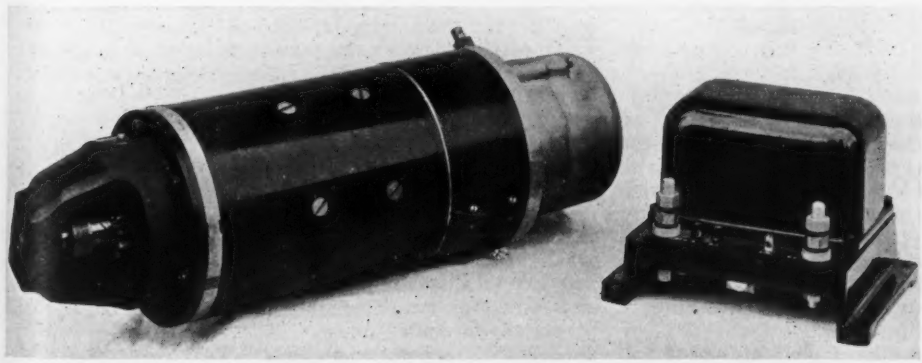
Electric Starter for Medium and Large Railcar Engines

A NEW range of starting motors has been added to the C.A.V.-Bosch selection, and is intended principally for operating in conjunction with powerful railcar oil engines. Known by the code number S7, the new starter is of the non-axial type, and is fed by 24-volt current. It in no way supersedes the usual C.A.V.-Bosch axial pattern starter, but is complementary to that type. It incorporates the familiar drive having a moving pinion on a helical thread for engagement with the rim of the engine flywheel.

The diversion from the axial method of engagement for starters for the larger type of high-speed engine has been made possible by a two-stage operation, using an electro-magnetic control switch mounted away from the starter, and a trip switch incorporated within the starter itself. When the starter button is depressed, one section of the magnetic switch is excited so that the resistance coil is connected in series with the starter. The resultant reduced voltage fed to the starter turns the armature and pinion at a low speed, so that the pinion moves forward on its sleeve very slowly and engages gently with the teeth on the flywheel without the damaging effect which would result if the full voltage was applied. Towards the end of its forward movement the pinion closes the trip switch mounted within the starter, and this excites the second section of the magnetic switch so that the starter resistance winding is short-circuited and the full starting current begins to flow.

Once the engine is started the pinion is accelerated by the flywheel and brought out of mesh automatically by the spiral-threaded sleeve, so that the trip switch is operated and the resistance brought into circuit to reduce the speed; the starter will continue to run at this speed until the starter button is released.

Owing to the erratic and irregular torque of some oil engines there is a tendency in such cases for the pinion to oscillate along its threaded sleeve; this would result in the trip switch being operated intermittently, preventing full torque being developed throughout the starting period. This difficulty has been overcome in the new C.A.V.-Bosch starter by including a special holding winding in the magnetic switch, and this ensures that the operation is correct until the engine fires or until the push button is released.

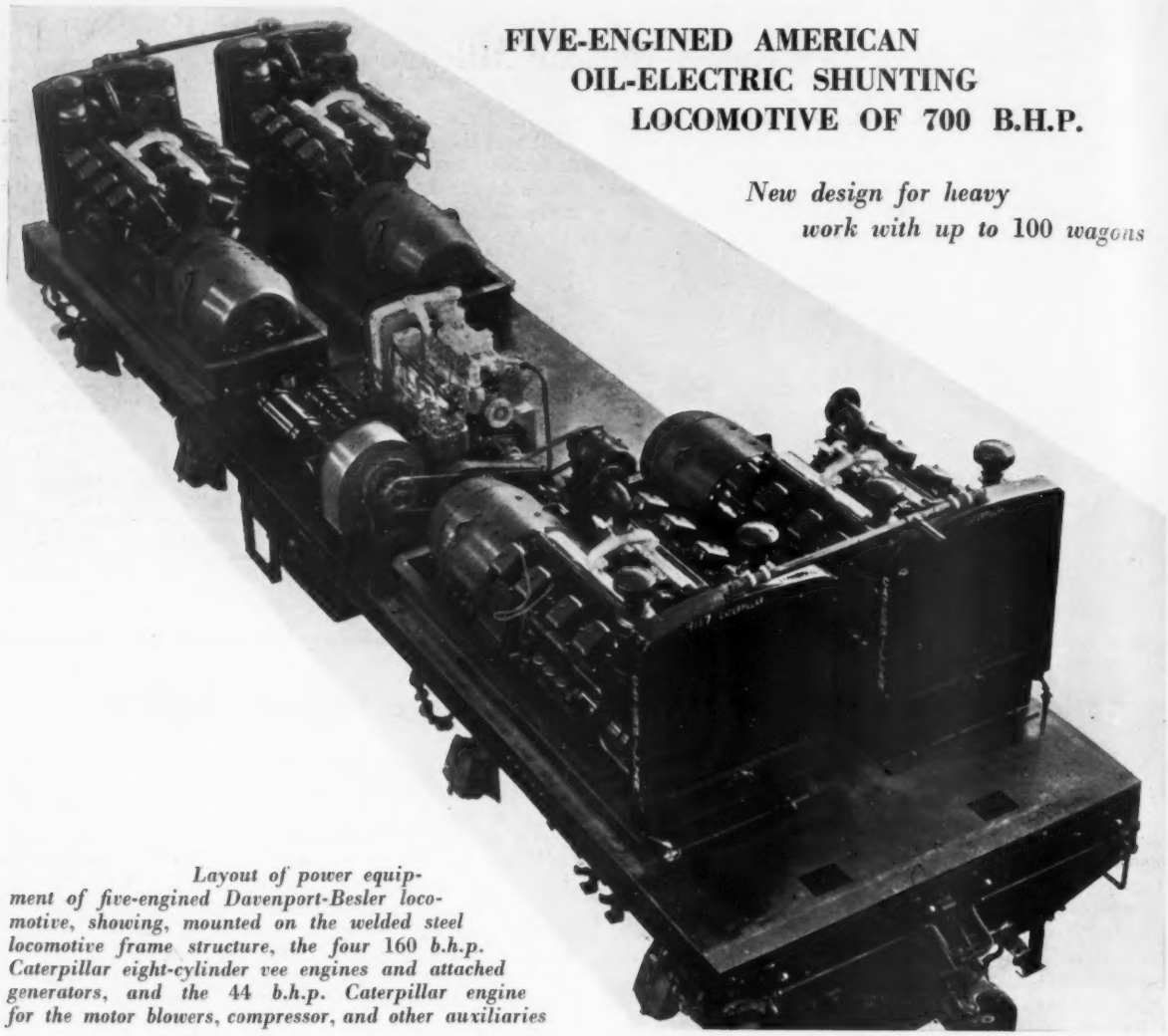


The new C.A.V.-Bosch non-axial starter for powerful high-speed engines, and, alongside, the separately mounted electro-magnetic control switch

XUM

FIVE-ENGINED AMERICAN OIL-ELECTRIC SHUNTING LOCOMOTIVE OF 700 B.H.P.

New design for heavy work with up to 100 wagons



Layout of power equipment of five-engined Davenport-Besler locomotive, showing, mounted on the welded steel locomotive frame structure, the four 160 b.h.p. Caterpillar eight-cylinder vee engines and attached generators, and the 44 b.h.p. Caterpillar engine for the motor blowers, compressor, and other auxiliaries

WHAT is, for America, a new type of diesel-electric shunting locomotive, has just been introduced by the Davenport-Besler Company. Although of the double-bogie four-motor steeple-cab type so much favoured in the U.S.A., it is unusual in being powered by four oil engines, with a fifth engine for the auxiliaries.

The four main engines are of the eight-cylinder vee type made by the Caterpillar Tractor Company, of Peoria, Ill., and they each develop a maximum output of 160 b.h.p. at 1,000 r.p.m. The cylinders are 5¾ in. bore by 8 in. stroke, giving a m.e.p. of 85 lb. per sq. in. and a piston speed of 1,335 ft. per min. at the top output; the corresponding torque is 695 lb.-ft. and the fuel consumption 0·44 lb. per b.h.p.hr. The minimum fuel consumption is 0·43 lb. per b.h.p.hr. at 125-135 b.h.p. at 850 r.p.m. The maximum torque and m.e.p. values are obtained at about 650 r.p.m., the respective magnitudes being 1,020 lb.-ft. and 93 lb. per sq. in. The auxiliary engine is a Caterpillar four-cylinder 44 b.h.p. vertical type with cylinders 4¼ in. by 5½ in., and running at 1,400 r.p.m.; it drives a 5 kW. auxiliary generator which charges the battery and operates controls and lights; it also provides power for the air brake compressor and the traction motor blower. Both the main and auxiliary engines have Burgess silencers, with the exhaust finally carried out through stacks above the bonnets; the main engines also are fitted with Donaldson air cleaners on the intake. Each engine has its own radiator and engine-driven radiator fan, and these are mounted with the engine and main generator as one unit on a heavy baseplate of steel channel which is securely bolted to the locomotive frame structure. The water cooling circuits of the two engines at each end of the locomotive are interconnected.

Self-ventilated shunt-wound main generators are used, and they supply current to four force-ventilated nose-suspended traction motors which drive the 40-in. wheels through 16:68 gears. Only one motor combination is possible, but there are weak-field notches over the higher range of speed up to the maximum of 40 m.p.h. The main engines are started by using the main generators as motors, each set being started up individually. The battery has a capacity of 215 amp.hr. 64 volts.

Mechanical Equipment

Welded steel plate construction has been utilised in the fabrication of the bogie frame structures, and the ensemble includes such details as the motor suspension brackets, brake cylinder supports, brake hanger and spring brackets, and side bearers. The axlebox guides have renewable steel faces, as have the side bearers. The bogies are supported by double nests of helical steel springs carried on double forged-steel equalisers. Solid rolled steel disc

wheels are used, and they are mounted on high-carbon forged and heat-treated steel axles having 7-in. by 13-in. journals. The underframe and superstructure are also of welded steel construction, the former being of heavy plates with two substantial channel sections acting as the centre sills; the centre drawgear is carried on the underframe. The central cab has an insulation board lining over the inside surface of the plates. Below the main underframe is a welded steel fuel tank with a capacity of 290 Imp. gal.; it is provided with a Protectoseal filler, a flame arrester vent, a Protectoseal sump for draining off water and sediment, a float-type sight gauge, and an electric level indicator on the cab instrument panel. There are two pneuphonic horns on the locomotive in addition to the usual bell.

Westinghouse 14EL air brake equipment is incorporated, and the air is furnished by a compressor with a capacity of 80 cu. ft. a minute; the reservoirs have a capacity of 23 cu. ft. All the brake rigging is carried on the bogie frames, including the cylinders, which are mounted on each side. The hand brake in the cab actuates the blocks on the wheels of one bogie only.

A maximum starting tractive effort of 63,000 lb. is permitted by the electrical equipment, but this corresponds to a factor of adhesion of 0·33; at 0·25 factor the tractive effort value is 52,500 lb. The weight in working order is 94 Engl. tons, with virtually equal axle loads in the static conditions. Over coupler knuckles the locomotive measures 42 ft.; the bogies have a wheelbase of 8 ft. and are pitched at 24 ft. centres. Curves with a minimum radius of 100 ft. can be negotiated.

700 b h.p. Davenport shunting locomotive

Brevities

AILSA CRAIG ENGINES.—Ricardo "Whirlpool" combustion chambers are a feature of a new series of oil engines—ranging from 10 to 200 b.h.p.—just introduced by Ailsa Craig Limited, of Chiswick, London, W.4.

TURKISH TRAINS.—The Turkish State Railways are to acquire diesel-mechanical multi-unit trains for service on standard-gauge lines. Each train is to be powered by two M.A.N. 420/450 b.h.p. oil engines which will drive through Mylius five-speed mechanical transmission.

WAR OFFICE DIESEL.—Andrew Barclay, Sons & Co. Ltd. has received another repeat order from the War Office for a diesel locomotive powered by a 180 b.h.p. Paxman–Ricardo engine, and fitted with a Vulcan-Sinclair fluid coupling and Wilson epicyclic gearbox.

OIL.—Three American oil companies, Socony-Vacuum, Texas, and Standard, are reported to have in hand a project for the development of oil properties in New Zealand. New oil deposits are understood to have been discovered in Eastern Siberia at a depth of less than 700 ft.

GARDNER PATENT.—L. Gardner & Sons, Ltd., has patented an arrangement for the use of inlet and exhaust valves near the edge of the cylinder head, so that the centre of the plain combustion space is left clear for the atomiser. It is proposed to have an arrangement of rockers for operating twin valves simultaneously.

LOCOMOTIVES FOR ARGENTINA.—Two broad-gauge diesel locomotives have been ordered by the Eagle Oil & Shipping Co. Ltd. from Hudswell, Clarke & Co. Ltd., for service in Argentina. Each locomotive will have a Gardner 8L3 engine developing 200 b.h.p. at 1,200 r.p.m. and fitted with flame-proof equipment.

MAYBACH ENGINES.—Including the 63 pressure-charged Maybach engines to be built under licence by Werkspoor for the Netherlands Railways, there are now 650 Maybach oil engines, in powers of 150 to 600 b.h.p., in rail traction service, and they aggregate approximately 250,000 b.h.p. Railcars and railcar trains with Maybach engines have now covered over 70,000,000 miles.

AMERICAN 3,600 B.H.P. LOCOMOTIVES.—Two further 3,600 b.h.p. diesel-electric locomotives have been delivered to the Baltimore & Ohio Railroad by the Electro-Motive Corporation. They are being used to haul the Columbian and Royal Blue trains between New York and Washington, and are duplicates of the locomotives hauling the Capitol Limited between Chicago and Washington, and described in the issue of this Supplement for April 16 and July 9, 1937. There are now eight main-line diesel-electric locomotives of 1,800 or 3,600 b.h.p., all with Winton two-stroke engines, on the B. & O. Railroad.

ARGENTINE DIESELS.—The order for five Ganz diesel trains placed by the Argentine Government on behalf of the Cordoba Central Railway, announced in our issue of July 8, has been increased to seven trains, all of the triple-car diesel-mechanical type. The five train sets will operate on suburban traffic, and will have a 320 b.h.p. Ganz engine and five-speed gearbox at each end. The two train sets will be of the same power and general mechanical layout and will have the same top speed of 95 km.p.h. (59 m.p.h.), but will be air-conditioned. They are to provide a *de luxe* service on the Cordoba–Catamarca line. Both types of train are for the metre gauge.

DIESEL ADVENTURES IN CEYLON.—The front windscreen of one of the English Electric diesel trains on the Ceylon Government Railways was smashed recently by what appeared to be a heavy stone suspended from the branch of a tree overhanging the line between Colombo and Galle. The train was delayed about 20 min. Subsequent investigations showed that it was a 7-lb. lead weight which was hanging from the tree, and it is believed that the culprits were the hirelings of some local bus men, whose traffic the railway diesel trains have succeeded in recapturing. The glass behaved just as armoured plate glass should; the driver ducked and let go the dead-man handle, and the train came to a standstill.

XUM

RAILCAR OIL ENGINE TESTS

SOME time ago the Automobile Club of France undertook on behalf of the then big five French railways a series of comprehensive tests on a number of high-speed oil engines which were then being offered for railcar work by French makers. The tests included running at full, fractional, and over loads, and a 72-hr. continuous test at the normal rating. Full particulars of the trials undertaken with the Renault six-cylinder engine of 150 b.h.p. were given in the issue of this Supplement for October 30, 1936, but the table accompanying this article gives the salient characteristics of ten of the engines submitted for test. Descriptions of most of these engines—either as built in France or as built elsewhere by the licensors—have already been given in these pages at one time or another, but as a refresher brief notes on all of them are appended.

Renault.—The six-cylinder 150 b.h.p. engine forms one bank of the 12-cylinder vee engine of 300 b.h.p., with the necessary changes to the crankcase and other details. It weighs about 2,550 lb. whereas the 300 b.h.p. engine scales approximately 4,820 lb. The compression ratio in both types is about 16 to 1, and the fuel is injected directly at a pressure of about 2,850 lb. by a Précision pump. The crankcase and cylinder block is an integral casting of aluminium alloy. Two inlet and two exhaust valves are fitted in each cylinder head. The big-end bearings have lead-bronze on the top half and whitemetal on the bottom half. The stroke of 170 mm. now applies to both banks of cylinders in the vee engine, as all the rods drive the crankpins direct without any articulated joint. The 16-cylinder vee 500 b.h.p. engine has increased cylinder sizes compared with the 300 b.h.p. unit, giving a higher piston speed and lower m.e.p. at the normal output. The rod bearings are the same as those of the 300 b.h.p. engine, but the first two 500 b.h.p. units had needle roller bearings to the gudgeon pins, articulation joints, and big ends. The weight of this engine approximates to 16 lb. per b.h.p.

Sulzer.—The 6LF19 model entered by the French Sulzer Company was designed originally for bogie mounting, and has a somewhat shorter stroke than, and other modifications to, the 6LD19 model of almost the same power which is used for underframe mounting. The weight is about 4,600 lb. and the maximum output 320 b.h.p. at 1,200 r.p.m. A combination of welded and cast steel construction is used for the cylinder block and crankcase structure. The Bosch type of fuel pump is used. The cylinder heads are cast independently, and each carries one inlet and one exhaust valve. Aluminium alloy pistons are used. The big-end bearings have whitemetal linings on bronze shells and the main bearings whitemetal on steel shells.

Ganz.—The eight-cylinder Alsthom-Ganz engine entered for the French trials was of the type used on the Dutch, Belgian, and Argentine Railways, and has a peak output of 410 b.h.p. at 1,450 r.p.m. In actual service it is limited to give anything from 320 to 380 b.h.p. It embodies the Jendrassik precombustion chamber and the fuel is supplied through Ganz fuel pumps. An aluminium alloy crankcase is used, and on it are mounted cast-iron cylinder blocks, cast in pairs. The engine weight is about 7,500 lb.

D.W.K.—The eight-cylinder 180 b.h.p. Deutsche Werke Kiel horizontal engine, entered by that company's French licensees, the Acieries du Nord de France et de Mureaux (A.N.F.), was the first railcar engine to incorporate the Lanova combustion chamber, and was the forerunner of the present German standard 12-cylinder 275 b.h.p. horizontal engine. The top output at 1,500 r.p.m. is over 200 b.h.p. The common crankcase and the two cylinder blocks are all of cast iron, and fuel is fed to the cylinders by two four-ram Bosch pumps mounted at one end. Each crankpin carries two big ends, one forked over the other. The engine weight is about 2,950 lb. in the dry condition but including the starter motor.

Acenor.—Made under licence from M.A.N. by the Acieries du Nord, the 210 and 280 b.h.p. models are characterised by an extremely low stroke to bore ratio. Welded steel crankcases and cylinder blocks are incorporated in some of the engines. M.A.N. fuel pumps are used as a rule and inject through Bosch atomisers. The weight of the six-cylinder 210 b.h.p. engine is 3,300 lb. and of the eight-cylinder 280 b.h.p. engine, about 4,200 lb. Incidentally, the 280 b.h.p. engine has been supercharged in some cases to give 350 b.h.p.

Prior to these tests another series had been conducted with eight types of engine giving 100 to 150 b.h.p. as their normal output at speeds of 1,200 to 1,600 r.p.m. These engines included Renault 110 b.h.p., Alsthom-Ganz 150 b.h.p., and Berliet 100 and 120 b.h.p. models.

TEST RESULTS ON FRENCH RAILCAR OIL ENGINES

Engine make	Renault	Renault	Renault	Als-Thom-Ganz	Acenor (M.A.N.)	Sulzer	A.N.F. (D.W.K.)	A.N.F. (D.W.K.)	Corpet-Frichs	Corpet-Frichs
Injection system	Direct	Direct	Direct	Pre-combustion	Air cell	Direct	Lanova	—	Direct	Direct
Number of cylinders	6	12	16	8	8	6	8	6	8	12
Bore and stroke, mm.	140×170	140×170 / 140×179·5	156×180	170×240	175×180	190×230	128×180	180×240	175×260	165×200
Cylinder capacity, litres	16·13	32·26	55·04	43·6	34·64	39·1	18·51	36·6	50	51·04
Nominal b.h.p.	150	300	500	330	280	280	180	—	300	400
Average b.h.p. during test	150	300	510	332	280	280	160	265	304	407
Speed, r.p.m.	1,500	1,500	1,500	1,300	1,400	1,200	1,450	1,020	1,010	1,265
B.h.p. per litre at 1,000 r.p.m.	6·2	6·20	6·0	5·84	5·77	5·96	6·0	7·09	6·01	6·27
Mean effective pressure, lb. per sq. in.	79	79	77	75	74	76	76	90	77	80
Piston speed, ft. per min.	1,725	1,725	1,775	2,050	1,660	1,795	1,715	1,590	1,725	1,640
Unit weight, lb. per b.h.p.	15·5	16	15·5	20	16·1	16·3	19·1	16·2	20·5	21
Fuel consumption at full load, gr. per b.h.p.-hr.	175	197·9	184·9	197·4	200·7	181·5	195	181·3	170·4	184·9
Fuel consumption at ¾ load, gr. per b.h.p.-hr.	184	214·9	192·5	198·9	207·5	182·1	195·5	179·2	177	190·4
Fuel consumption at ½ load, gr. per b.h.p.-hr.	206	236·9	214·1	217	238	202·7	221	189·2	194·6	215·8
Lubricating oil consumption, gr. per b.h.p.-hr.	2·45	2·61	6·9	6·86	6·5	2·63	4·55	2·71	2·4	1·21

South American Diesel Railcar Operation

One of the metre-gauge 270 b.h.p. 36-ton Sulzer cars belonging to the Buenos Aires Provincial Railway

THE four Sulzer diesel-electric railcars shipped from Europe at the end of 1935 and set to work on the Buenos Aires Provincial Railway in March, 1936, have now covered an aggregate of over 1,000,000 km. (620,000 miles), equivalent to an average of something like 100,000 km. (62,000 miles) per year per vehicle, a most satisfactory result considering that local trains form the greater part of the duties and that under no conditions is the speed allowed to exceed 80 km.p.h. (50 m.p.h.). In the accompanying table is shown the mileages and work undertaken on the engines from March, 1936, to the end of 1937. The cars are used principally on the La Plata—Avellaneda line, over which they run a total of 1,298 km. (805 miles) a day. On the La Plata—Soma Verde route another 256 km. (160 miles) is made every day, and there are workings totalling 42 km. (26 miles) a day on weekdays over the short Avellaneda—Monte Chingolo line. Irregular excursions are operated also, principally between La Plata, Azul, and Olavarria, and when these are run the mileage increases by 610 to 660 km. (380 to 410 miles) per week-end.

Railcar No.	1	2	3	4
Total distance run, km. ..	193,974	206,393	198,390	213,872
Total fuel consumption, tons	59·3	68·1	65·8	73·0
Fuel consumption per km., grams	342	348	368	372
Total lubricating oil consumption, kg.	804·5	734·5	406·5	681
Lubricating oil consumption per km., grams ..	4·6	3·75	2·27	3·5
Do. including fresh fillings, total, kg.	1,519·5	1,304·5	949·5	1,596
Do. including fresh fillings, per km., grams	8·8	6·7	5·3	8·1
Number of times oil changed	5	4	4	6
Oil changed after an average of, km.	35,000	49,000	45,000	33,000
Intervals between separate overhauls amount to :				
Starting service till first overhaul, km.	7,056	25,396	32,842	32,193
Between first and second overhauls, km.	47,280	77,226	24,586	56,771
Between second and third overhauls, km.	97,742	92,950	72,262	22,503
Between third and fourth overhauls, km.	—	—	—	71,779
Longest uninterrupted time of service, *i.e.*, without the slightest interruption of service for repairs, inspections or overhauls :				
Service days	265	197	178	180
Corresponding to a running distance of, km. ..	97,742	77,226	72,262	71,779
Number of inspections of crankshaft and connecting rod bearings	4	3	4	4
Number of replaced crankshaft bearings	0	0	5/2	2+½
Number of replaced connecting rod bearings ..	0	2/2	½	2+2/2
Number of overhauls of pistons	2	2	3	2
Number of pistons replaced	0	0	0	0
Number of piston rings replaced	0	0	0	0
Measured maximum piston wear in diameter (*a*), mm.	Not measured	0·07	0·09	0·2
Do. in ring grooves (*b*), mm.	,,	0·1	0·07	0·1
Distance (*c*) run before measurements (*a*) and (*b*) ..	,,	102,622	129,690	88,964
Maximum wear of cylinder liners in diameter for same distance as (*c*), mm.	,,	0·10	0·14	0·03
Do. per 100,000 km., mm.	,,	0·097	0·108	0·034
Number of liners replaced ..	0	0	0	0
Number of suction and exhaust valves ground-in	2	1	2	1
Number of suction and exhaust valves replaced ..	0	0	0	0
Injection nozzles cleaned, times	3	1	3	3
Injection nozzles replaced ..	0	0	0	0
Fuel pumps inspected, times	4	2	4	4
Fuel pumps replaced ..	0	0	0	0
Valve gear inspected, times	2	2	2	2

RAILCAR FOR JAMAICA.—A double-bogie railcar powered by two Perkins high-speed light-weight engines and with Mylius four-speed gearboxes is being built for the Jamaica Government Railway by D. Wickham & Co. Ltd., of Ware.

BRAZILIAN LOCOMOTIVES.—The three 450 b.h.p. 1—Do—1 diesel electric locomotives built by the English Electric Co. Ltd. (as main contractor) and Robt. Stephenson & Hawthorn's Ltd. for the Eastern Railway of Brazil are ready for shipment.

FERODO AND FLUID COUPLINGS.—The French Ferodo Company, one of the biggest suppliers of friction linings for clutches, has taken out a non-exclusive licence from the Hydraulic Coupling & Engineering Co. Ltd. for the manufacture of Vulcan-Sinclair fluid couplings for diesel locomotives and railcars.

C.A.V.-BOSCH SPARES.—A complete list of spare parts for the maker's axial type starting motors has been issued by C.A.V.-Bosch Limited, of Acton, in order to give adequate information regarding, and quick identification of, any constituent. Similar lists are available for other C.A.V.-Bosch starting and lighting equipment.

AMERICAN DIESELS.—Supplementing the information relating to the number of diesel locomotives at work in the U.S.A., as given on p. 436 of the issue of this Supplement for September 2, in the diesel locomotives, trains and railcars in the U.S.A. and Canada are installed 520 *engines* with an aggregate of 300,000 b.h.p. The total b.h.p. installed from January 1, 1937, to the end of February, 1938, exceeded the total installed over the preceding 12 years.

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NOTES AND NEWS

Italian Diesel Activity.—Among the recent deliveries to the Italian State Railways is a total of 72 diesel railcars ; a further 135 oil-engined railcars are on order or in course of delivery.

Algerian Railcar.—De Dietrich & Cie, of Niederbronn, is building a powerful double-bogie railcar for Algeria. It is to be powered by two 6LDT19 Sulzer engines, built by the French Sulzer Company, and each giving a top output of 300 b.h.p. at 1,175 r.p.m.

Danish Diesel Stock.—According to the annual figures of the Danish State Railways there were 48 diesel-electric railcars, 8 streamlined diesel trains, and 9 diesel locomotives in service on the State lines at the end of March last.

German Private Railway Cars.—The number of internal-combustion engined railcars at work on the numerous German private railways, of both standard and narrow gauges, rose from 126 in 1933 to 166 in 1934, to 213 in 1935, and to 252 in 1936.

Greek Trains.—Eight articulated twin-car diesel-mechanical trains, each powered by two 210 b.h.p. engines have been set to work on the metre-gauge lines of the Piræus—Athens—Peloponnesus—Railway. The top speed is 40 m.p.h., the weight 56 tons, and the seating capacity 71 in two classes.

L.M.S.R. Diesel Train.—After much trial running, the L.M.S.R. three-car six-engined diesel-hydraulic train has been put into regular operation on the Oxford-Bletchley-Cambridge line on September 12, making through trips between the two university cities and other local trips. Some of the intermediate schedules average 50 to 53½ m.p.h. start-to-stop.

L'Allégement dans les Transports.—This well-known continental technical journal, published in Lucerne in alternate months, has changed its name to *Economie et Technique des Transports*, and from the beginning of 1939 will be published every month. It will now cover all transport work, including railway, road, marine, and air systems. As hitherto, the text of each issue will be in both French and German.

American Orders.—The Chicago Rock Island and Pacific has entered into a contract with the Electro-Motive Corporation for the leasing of 16 diesel-electric locomotives, with an option to buy, thereby bringing the total contracted for to 37, including 10 leased in April and 11 in March of this year. Of the 37 locomotives, 29 are of 600 b.h.p., and eight are of 900 b.h.p. The Inland Steel Company has ordered one 53-ton and one 41-ton 320-b.h.p. diesel locomotives from the Plymouth Locomotive Works. The New York Central Railroad is proposing to purchase a number of 600 b.h.p. shunting locomotives.

German Diesels.—According to the annual report of the Reichsbahn for 1937, railcars at the end of that year were maintaining 8·3 per cent. of the passenger train-km., against 7·6 per cent. at the end of 1936 and 6·1 per cent. at the end of 1935. Orders passed during 1937 included 111 diesel railcars and multi-unit trains of 225 to 1,200 b.h.p. Among the year's deliveries were two special light alloy 150-b.h.p. four-wheeled diesel cars, four similar vehicles of light all-steel construction, 30 railcars with comparatively slow-running (900 r.p.m.) 360-b.h.p. bogie-mounted diesel engines and Voith double-turbo hydraulic transmission, and a 330-b.h.p. railcar with mechanical transmission. The engines of nearly all of these railcars are suitable for burning oil obtained from lignite, if this should ever be necessary. A total of 58 railcars was delivered during 1937.

Narrow-Gauge Diesel-Hydraulic Railcar.—Increasing use is to be made of diesel railcars on the 76-cm. gauge lines of the German State Railway in Saxony. These lines have grades as steep as 1 in 30 and curves of 328 ft. radius. The double-bogie cars now at work have a Vomag horizontal single-bank eight-cylinder engine developing 180 b.h.p. at 1,500 r.p.m. (see issue of this Supplement for February 21, 1936). They have Voith double turbo hydraulic-transmission with electro-pneumatic control. Multiple-unit working is possible and Scharfenberg automatic multi-purpose couplings are fitted. The tare weight is about 20 tons.

French Colonial Locomotives.—Als-Thom is acting as main contractor for five metre-gauge diesel-electric locomotives for the Madagascar Railways. In each case a supercharged 6LDA25 Sulzer engine—built at the St. Denis works—will be used, and will have a normal output of 600 b.h.p. at 750 r.p.m. Als-Thom also has a contract for rebuilding the 920-b.h.p. M.A.N.-engined locomotive of the Algerian Railways (see issue of this Supplement for September 8, 1933). Two Sulzer 6LDA25 engines will be installed in the rebuilt locomotive, giving a total engine output of 1,200 b.h.p., or an increase of 30 per cent. over that of the original locomotive.

Queensland Railcars.—Among the duties now being performed by the Gardner-engined three-car trains of the Queensland Government Railways, as illustrated and described in the May 13 issue of this Supplement, is the operation of passenger traffic over the 217-mile Toowoomba-Roma line. The train leaves the first-named place at 12.30 p.m. and arrives at Roma at 9.10 p.m. ; there are 40 passenger stops *en route*, and two half-hour stops for refreshments. A total of 82 passengers and 1½ tons of luggage are carried on a tare weight of 27½ tons. In service on, or on order from, the Queensland Government Railways are 27 Gardner engines for railcars and one for a locomotive ; they comprise 20 engines of the 6LW type (102 b.h.p.), seven 4LW's (68 b.h.p.), and one 6L3 (153 b.h.p.) for the locomotive. The LW engines run at a top speed of 1,700 r.p.m. and the L3 engine at 1,200 r.p.m.

French Locomotive Performance.—The 1-Do-1 oil-electric locomotive with one 800-b.h.p. 8LD28 Sulzer engine, which was put into service on the Ceinture line in February, 1933, and later transferred to the Nord, had completed a total of 19,357 hours of actual work to the end of 1937, the total for the year 1937 itself being 3,325 hr., spread over 330 days. Since being put into service in 1933, the aluminium alloy pistons had been worn by an average of 0·05 mm. The cylinder liners had worn 0·05 to 0·10 mm. measured at a point 2 in. below the top after about 3,300 hr. service. The main bearings were still in an excellent state, and only two lower halves had been replaced. The replacements during the first five years, amounting only to two new gudgeons, a set of liners, two half-bearing shells, piston rings and liner joint rings, gaskets, and fuel pump plungers. The original liners were renewed after about 15,700 hr. of service, when the wear near the top was 0·9 to 1·0 mm. For the first three years the repair cost of the complete locomotive averaged only fr.0·62 per km., and has not been appreciably increased since. To the end of 1937 the actual distance run, practically all in shunting work, was approximately 175,000 km.

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